Biodiversity Status and Trends in the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania Region, 2008-2013

Roy E. Gereau, Mercy Kariuki, P. Kariuki Ndang'ang'a,
Chacha Werema & Paul Muoria

BirdLife INTERNATIONAL | Partnership for nature and people
Missouri Botanical Garden
NatureKenya The East Africa Natural History Society
CRITICAL ECOSYSTEM PARTNERSHIP FUND

TABLE OF CONTENTS

Acknowledgements 3
List of Acronyms 4
Executive Summary..... 6
1.0 Introduction and Background..... 16
2.0 Approach and Methodology..... 18
3.0 Results..... 19
3.1 Status and trends..... 19
3.1.1 Forest Quality and Health..... 19
3.1.2 Area of different types of forest and degree of fragmentation... 21
3.1.2.1 Forest area..... 21
3.1.2.2 Fragmentation..... 22
3.1.3 Presence of endemic and globally threatened species, changes in species IUCN Red List category, changes in site status, and new species descriptions..... 22
3.1.3.1 Presence of endemic and globally threatened species..... 22
3.1.3.1.1 Amphibians..... 22
3.1.3.1.2 Birds..... 23
3.1.3.1.4 Mammals..... 24
3.1.3.1.5 Plants..... 24
3.1.3.2 Changes in species IUCN Red List category..... 26
3.1.3.3 Changes in site status..... 31
3.1.3.4 New species descriptions..... 32
3.1.4 Percentage of area within protected areas..... 33
3.1.5 Carbon storage..... 34
3.2 Pressure..... 35
3.2.1 Impact scores for Kenyan IBAs..... 35
3.2.2 Change in extraction intensity of key species..... 36
3.2.3 Changes in human population density in wards, divisions in the EACF..... 39
3.2.4 Presence and coverage of invasive species..... 39
3.2.5 Fire frequency..... 40
3.3 Response Indicators..... 40

TABLE OF CONTENTS

3.3.1 Response scores for Kenyan IBAs..... 40
3.3.2 Changes in forest management effectiveness..... 41
3.3.3 Actions and research targeting biodiversity..... 43
3.3.3.1 Amphibians..... 43
3.3.3.2 Birds..... 44
3.3.3.3 Mammals..... 44
3.3.3.4 Plants..... 45
3.3.4 Policy development (including site, species, and focused issues..... 45
3.3.5 Number of sites from which benefits accue to local communities... 48
4.0 Conclusions and Recommendations..... 50
References..... 53
Appendix 1: List of a collapsed set of monitoring indicators and tools for aggregating information at the regional level as agreed by stakeholders in the EACF..... 62
Appendix 2: Habitat use of Long-billed Tailorbird Artisornis moreaui in the East Usambara mountains (Tanzania)..... 64
Appendix 3: Drifting into extinction: results from the long-term monitoring of Taita apalis Apalis fuscigularis..... 68
Appendix 4: Inventoried sites in EACF with IBA and KBA status and numbers of listed taxa in 2012 and 2013..... 72
Appendix 5: Botanically uncollected protected areas of EACF in Tanzania by Region, District, and size..... 77

Biodiversity Status and Trends in The Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania Region, 2008-2013

Roy E. Gereau[1], Mercy Kariuki[2], P. Kariuki Ndang'ang'a[2], Chacha Werema[3] & Paul Muoria[4]

[1] Missouri Botanical Garden

[2] BirdLife International - Africa Partnership Secretariat

[3] University of Dar es Salaam

[4] Nature Kenya

Design and Layout
Kalekye Maggie
maggiekalekye@gmail.com
maggie@tarajimarketing.com

ISBN No. 978-9966-7191-9-5

Recommended Citation: Gereau, R. E., Kariuki, M., Ndang'ang'a, P. K., Werema, C. & Muoria, P. (2014) Biodiversity Status and Trends in the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania Region, 2008-2013. Nairobi: BirdLife International - Africa Partnership Secretariat

ACKNOWLEDGEMENTS

The authors are grateful to Viola Clausnitzer, Jens Kipping, and Klaas-Dowe Dijkstra for providing their unpublished data. We thank Norbert Cordeiro, Charles Lange, Patrick Malonza, Francesco Rovero, and Philip Shirk for helpful comments and corrections on the Outcomes Database. Neil Burgess and Nike Doggart provided extremely useful review comment on the manuscript. The first author is grateful to Quentin Luke for immense amounts of plant data and to all of the members of the Eastern African Plant Red List Authority (EAPRLA) for their long and faithful service to plant conservation assessment. We gratefully acknowledge all other contributors, too numerous to mention individually by name, who provided reports, publications, and data used in the compilation of this report.

Funding for this work is made available by the Critical Ecosystem Partnership Fund (CEPF), a joint programme of l'Agence Française de Développement, Conservation International, the Global Environment Facility, the Government of Japan, the MacArthur Foundation, and the World Bank.

LIST OF ACRONYMS

CBO	Community Based Organization
CDTF	Community Development Trust Fund
CEPF	Critical Ecosystem Partnership Fund
CFA	Community Forest Association
EACF	Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania
EAMCEF	Eastern Arc Mountains Conservation Endowment Fund
EAMs	Eastern Arc Mountains
EAPRLA	Eastern African Plant Red List Authority
EIA	Environmental Impact Assessment
FR	Forest Reserve
GEF	Global Environment Facility
IBA	Important Bird Area
IPCC	International Panel on Climate Change
IUCN	International Union for the Conservation of Nature
IUCN-SSC	International Union for the Conservation of Nature - Species Survival Commission
KBA	Key Biodiversity Area
KWS	Kenya Wildlife Service

METT	Management Effectiveness Tracking Tool
NEMA	National Environment Management Authority
NMK	National Museums of Kenya
NP	National Park
NR	Nature Reserve
PA	Protected Area
PFM	Participatory Forest Management
RAP	Resettlement Action Plan
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	Reducing Emissions from Deforestation and Forest Degradation plus carbon enhancement
SAI	Sustainable Agricultural Intensification
SEA	Strategic Environmental Assessment
SLM	Sustainable Land Management
SOC	Soil Organic Carbon
TFS	Tanzania Forest Service
WCPA	World Commission on Protected Areas
WWF	World Wildlife Fund

Executive Summary

1. This report assesses the status and trends of biodiversity in the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania (EACF) up to the end of 2013 and into early 2014. It follows the 2008 and 2012 status and trends reports and therefore status is assessed against the 19 biodiversity monitoring indicators agreed upon by stakeholders. This process is particularly important for Key Biodiversity Areas (KBAs) that are planning to build strong cases for REDD+ projects.

2. Indicators are grouped in such a way that they assess STATE (changes in forest quality and health, areas of different types of forest and degree of fragmentation, presence and abundance of threatened species and infraspecific taxa, percentage of area within protected areas (PAs), and carbon storage), PRESSURE (change in extraction intensity of key species, human population, presence and extent of invasive species and fire frequency), and RESPONSE (changes in forest management effectiveness, actions and research targeting biodiversity, policy development, sites from which benefits accrue to communities). The findings of the 2012 status and trends report formed the baseline for the current assessment.

3. RESULTS

3.1. STATE

3.1.1. Forest quality and health: Evidence continues to emerge supporting the effectiveness of Participatory Forest Management (PFM) in coastal forests of Kenya and Tanzania and in the Eastern Arc Mountains (EAMs) as measured by increased populations of wild game species, forest quality, and reduction of human disturbance of forests. Human disturbance in coastal forests impacts negatively on bird species diversity and richness, and clearing natural forests for exotic plantations leads to an unstable plant population structure. Sustainable agricultural intensification (SAI) and sustainable land management (SLM) practices may be able to attenuate environmental degradation in the Usambara Mountains, and alternative farming practices and tree nursery management may improve crop yields, control erosion, and rehabilitate watersheds in the Uluguru Mountains. Monitoring of 15 Kenyan coastal forest Important Bird Areas (IBAs) from 2004 to 2011 showed no significant overall change in biodiversity status scores. Two IBAs remained in an 'unfavorable' status for all the years assessed; one underwent substantial decline in habitat area and quality; and one underwent a modest improvement. Assessment of threats and

disturbances in eight Nature Reserves (NRs) and one National Park (NP) in the EAMs of Tanzania showed five major threats, with forest disturbance most pronounced in Mkingu NR (Nguru Mountains) and Uluguru NR, and least in Amani NR and Udzungwa Mountains NP.

3.1.2. Area of different types of forest and degree of fragmentation: Deforestation rates in Tanzanian coastal forests are highest in Pwani and Mtwara Regions, with a decrease in closed forest cover of 25.3% at Pugu FR and 31.3% at Kazimzumbwi FR during the period 1995-2010. Kenyan coastal forests show steady forest loss but deforestation rates have not been extensively quantified. Demand for woodfuels is a key driver of deforestation and land degradation in Dakatcha woodlands, whose IBA demarcation is being reconsidered in light of woodland fragmentation, with a large-scale irrigation project and a projected pineapple plantation as further threats. Cloud forest in the Taita Hills is being lost to agriculture and bushland, but total forest cover increased between 1985 and 2010, at least in part due to plantations of exotic trees. Montane forest, closed woodland, and grassland were lost in the Nguru Mountains between 1984 and 2000 due to anthropogenic disturbance, and models of habitat loss in the EAMs predict losses of a further 5% of forest and 42% of woodland by 2025. The Endangered Tana River crested mangabey, *Cercocebus galeritus*, enhances the connectivity of fragmented Tana River gallery forests by seed dispersal. Chameleons in the East Usambara Mountains have a differential response to forest fragment area, with species from the interior of closed forest showing greatly decreasing population density in small fragments, and species preferring forest edge habitats showing a somewhat higher population density in small fragments.

3.1.3. Presence of endemic and globally threatened species, changes in species IUCN Red List category, changes in site status, and new species descriptions

3.1.3.1. Presence of endemic and globally threatened species: The Kihansi spray toad, *Nectophrynoides asperginus*, listed as Extinct in the Wild, has been successfully reintroduced into its native habitat, and the Critically Endangered *N. wendyae*, also endemic to the Uzungwa Scarp FR, has been found at a second site. Range extensions are reported for threatened frog species in the North and South Pare Mountains and the West Usambara Mountains. The Critically Endangered Long-billed tailorbird, *Artisornis moreaui*, known only from Amani and Nilo NRs in the East Usambaras, occurs only inside or along edges of continuous forest,

and its abundance is depressed by presence of the invasive tree species *Maesopsis eminii*. The known range of the Critically Endangered Taita Apalis, *Apalis fuscigularis*, has been slightly expanded by new studies, but the total population increase is not significant and the three main subpopulations continue to decline. The Critically Endangered Taita Thrush, *Turdus helleri*, is suspected to be in decline, and the Vulnerable White-winged Apalis, *Apalis chariessa*, is now suspected to be nationally extinct in Kenya. Range extensions are reported for four threatened dragonfly and damselfly species in the EACF. Recent studies have reported the presence of the Endangered Abbot's duiker, *Cephalophus spadix*, from three additional sites in the Udzungwa Mountains, and the Vulnerable Haggard's oribi, *Ourebia ourebi*, in the Boni and Dodori landscape. Two plant species previously thought to be extinct, the Lake Lutamba coral tree, *Erythrina schliebenii*, and *Karomia gigas*, have been rediscovered in a small forest patch in Kilwa District (Tanzania), and *E. schliebenii* has been propagated and planted in the State House Gardens in Tanzania.

3.1.3.2. Changes in species IUCN Red List category: Following review of the IUCN Red List, 410 globally threatened taxa (species, subspecies, varieties) in the EACF have been added to the EACF Outcomes Database in 2013. New taxa added to the database include members of some previously unrepresented Classes of animals (Malacostraca: 4 taxa; Reptilia: 11 taxa) and plants (Liliopsida: 105 taxa; Lycopodiopsida: 1 taxon; Polypodiopsida: 20 taxa). Adding these 410 new taxa to the 2012 database and subtracting the 24 taxa previously listed in threatened categories that have been downgraded to non-threatened status, the total number of globally threatened taxa in the EACF is 756. Between 2008 and 2013 a total of 44 taxa in the EACF had their IUCN Red List status changed: 26 were upgraded to higher threat status, 16 were downgraded to lower threat status, and 2 taxa previously assessed as Data Deficient were assigned definite threat status.

3.1.3.3. Changes in site status: A total of 1,419 new distribution records were added to the Outcomes Database in 2013 and distribution records for the 24 taxa no longer in threatened categories were removed, resulting in many changes in the numbers of threatened taxa reported from 173 sites (mostly KBAs) within the EACF. A total of 100 sites showed a net gain in threatened taxa; 62 sites had no net change; and 11 sites had a

net loss. The Uluguru Mountains had the largest net gain (101) as well as the largest total number (197) of threatened taxa. No site experienced a net loss of more than 2 threatened taxa. As a result of these changes, 17 sites in the EACF not previously classified as KBAs may now qualify as such. One site (Tumbatu Island, Tanzania) lost its only threatened taxon when the Eastern tree hyrax, *Dendrohyrax validus*, was downgraded from Vulnerable to Least Concern, and seven other sites have no threatened taxa on the 2013 Outcomes Database due to being merged into other sites or not having had any threatened taxa in 2012; the KBA status of these eight sites should be reconsidered.

3.1.3.4. New species descriptions: *Arthroleptis anotis*, a new frog species endemic to the South Pare Mountains, was described in 2011. The 2012 status and trends report listed 19 new herpetofauna species from the South Nguru Mountains, indicated new species of gecko, tree frogs, forests snakes, and chameleons yet to be named, listed a new sengi (elephant shrew) species described from the Udzungwa Mountains in 2008, and indicated another possible new species of sengi from Boni and Dodori Forests. *Dorstenia christenhuizii*, a new plant species in the family Moraceae, was described from the Taita Hills in 2013.

3.1.4. Percentage of area within protected areas: The percentage of the EACF within PAs increased in 2010 by the gazettement of Derema FR in the East Usambara Mountains. In 2011 this percentage was further increased by the establishment of two village FRs in the Rubeho Mountains; twelve village FRs in Kilwa District; ten village FRs in Lindi Rural District including much of the Noto and Chita plateaux; one community FR in the East Usambara Mountains; three village FRs in the lowland South Nguru Mountains; and 16 village FRs in the Rubeho and Ukaguru Mountains. The percentage of area within PAs did not change in 2012 or 2013, but the level of available knowledge of the biodiversity of various PAs is extremely uneven. In the Regions and Districts of Tanzania containing the EACF, 124 PAs representing a surface area of 6,680 km^2 have no herbarium specimen collections in the principal national, regional, and international botanical institutions housing Tanzanian plant collections, and their plant diversity thus remains unknown.

3.1.5. Carbon storage: Studies in the Taita Hills have quantified aboveground biomass, carbon sequestration capacity, biomass carbon densities, and soil organic carbon densities, and determined that mean

total biomass densities for indigenous forests are significantly greater than for plantations of exotic tree species. For the period between 1999/2003 and 2010/2011, carbon loss due to deforestation in eight NRs and one NP in the EAMs of Tanzania were highest in Amani NR (31,247 tons/year) and lowest in Uzungwa Scarp NR (158 tons/year); Uluguru NR and Udzungwa Mountains NP had no carbon loss in this period. Carbon storage values for all five IPCC carbon pools (aboveground live carbon, litter, coarse woody debris, belowground live carbon, and soil carbon) in the entire EAM watershed were estimated at 6.33 Pg, much higher than estimates from most previous studies. Carbon stored in the remaining coastal forests of Tanzania in 2007 was estimated at 17 Mt. Low aboveground carbon densities in Pugu FR and Kazimzumbwi FR were attributed to decline in area under closed forest during the period 1995-2010.

3.2. PRESSURE

3.2.1. Pressure/threat scores for Kenyan IBAs: Mean pressure scores for 15 Kenyan coastal forest IBAs varied significantly over the years 2004-2011, with the lowest pressure score in 2006 and the highest in 2008. Specific threats included poaching for bush meat, firewood collection, selective logging, charcoal burning, agricultural clearing and encroachment, and fire in both grasslands and forest. Overall, the level of threats facing Kenyan IBAs rose significantly between 2004 and 2011, driven primarily by expanding human population.

3.2.2. Change in extraction intensity of key species: Timber extraction, charcoal burning, and fire are the primary drivers of forest degradation and deforestation in Kilwa District, Tanzania. The Vulnerable African/White mahogany, *Khaya anthotheca*, is among the most harvested tree species; Near Threatened tree species that are heavily impacted include *Dalbergia melanoxylon* (Mpingo in Swahili), *Pterocarpus angolensis* (Mninga), *Milicia excelsa* (Mvule), and *Brachylaena huillensis*. *Julbernardia globiflora*, one of the dominant trees in Miombo woodland, is among the species most preferred for charcoal. Market surveys show that unsustainably harvested *Khaya anthotheca*, *Pterocarpus angolensis*, and *Milicia excelsa* from the EAMs are becoming difficult for carpenters, sawyers, and dealers to obtain. In the Kilombero Valley, the creation of better alternative economic activities is a more cost-effective means of reducing poaching of wildlife for the bush meat trade than punitive measures. The relative abundance of five species of diurnal primates was compared between two forest blocks in the Udzungwa Mountains, one well protected (Udzungwa Mountains NP) and one without protection

(Uzungwa Scarp FR), with measurement of abundance changes between 2004 and 2009. Increased hunting in the unprotected forest has greatly reduced the population of the canopy-dwelling colobine monkeys (the Endangered Udzungwa red colobus, *Procolobus gordonorum*; and the East African black-and-white colobus, *Colobus angolensis* subsp. *palliatus*), while the more ecologically adaptable cercopithecine monkeys (the Endangered Sanje mangabey, *Cercocebus sanjei*; and Sykes' monkey, *Cercopithecus mitis*), were more abundant in the unprotected forest and did not decline significantly. Unsustainable charcoal production is a major factor in the decline of forest cover and habitat fragmentation in Dakatcha woodlands, with likely negative impacts on the Endangered Clarke's weaver, *Ploceus golandi*, the Endangered Sokoke pipit, *Anthus sokokensis*, the Vulnerable Sokoke scops owl, *Otus ireneae*, the Vulnerable shrub *Pavetta linearifolia*, and the Vulnerable Bushy-tailed mongoose, *Bdeogale omnivora*.

3.2.3. Change in human population density in wards, divisions in the EACF: Kilwa District, Tanzania, has a relatively low overall human population density of ca. 16 individuals/km^2. However, population growth is resulting in rapid agricultural expansion and forest clearing to place more land under shifting cultivation. Residents of villages with PFM in place have begun to understand the need to farm permanent plots or re-use abandoned fields, reducing the need for further forest clearing. Human population increase is a causal factor in the degradation of Dakatcha woodland and loss of biodiversity. All parts of Zanzibar and Pemba are threatened by very high population density with an estimated 5% annual growth rate.

3.2.4. Presence and coverage of invasive species: At least 22 plant species are invasive in the EAMs of Tanzania. *Maesopsis eminii* is the most serious threat to Amani NR and has a differential effect on common and rare bird species in the East Usambara Mountains. Invasion by *M. eminii* has no significant effect on the frequency of the nine commonest forest bird species, but has highly significant effects on five out of eleven rare bird species, including the Critically Endangered Long-billed tailorbird, *Artisornis moreaui*, and the Near Threatened Fischer's turaco, *Tauraco fischeri*.

3.2.5. Fire frequency: Forest fire is a major threat in all of eight NRs and one NP in the EAMs of Tanzania, with a general decline in fire along the forest edge in Chome NR, and fire problems significantly contained in Magamba NR. Much of Kilwa District, Tanzania, has a fire frequency of 1-3 years in coastal forest and woodland, with annual fire converting

miombo woodland to grassland.

3.3. RESPONSE

3.3.1. Response scores for Kenyan IBAs: Response scores for 15 Kenyan coastal forest IBAs showed a significant annual variation over the years 2004-2011. Law enforcement measures brought about some improvements in Arabuko-Sokoke Forest, Shimba Hills, and Taita Hills, while response scores remained low in Dakatcha woodlands due to lack of legal protection status. Nature Kenya has been implementing donor-funded conservation programs in Dakatcha woodland and Taita Hills forests.

3.3.2. Changes in forest management effectiveness: The World Commission on Protected Areas (WCPA) management effectiveness tracking tool (METT) was applied to 397 forest sites within the EACF between 2004 and 2012. Resurvey of eleven Kenyan coastal forests in 2008 showed a decline in management effectiveness at four sites and an improvement at two sites. Private forests in the EAMs of Tanzania had higher METT scores than government FRs and village forests. In Tanzanian coastal forests, NPs and village land forests reserves managed at the village level had the highest METT scores, while National and Local Authority FRs had generally low scores. METT scores were calculated in 2013 for 27 Tanzanian coastal forests, 24 of which had been previously assessed in the 2004-2012 period. Three of the forests had scores in the range considered Poor, all of them National and Local Authority FRs. Four forests had Very Good scores: one National Authority FR, one NR, one Community Forest, and one NP. METT scores from the 2013 study were generally higher than in the previous study. The METT was applied to eight NRs and one NP in the EAMs of Tanzania, all of which had previously been FRs. All nine sites had Good or Very Good METT scores; comparison with previous assessments indicates that upgrading of FRs to NRs is a successful conservation and management strategy. Evidence of positive impacts resulting from changes from private to state tenure in three forest blocks in Amani NR further supports the effectiveness of establishing NRs.

3.3.3. Actions and research targeting biodiversity:

3.3.3.1. Amphibians: Evaluation of amphibian composition along transects in the Taita Hills between April 2006 and January 2007 showed that amphibian species richness increased with increased habitat disturbance but decreased with increasing elevation. However, abundance of species that reproduce by direct

development, which are restricted to forested habitats, decreased with increased habitat disturbance. Mt. Kilimanjaro and Mt. Meru have far fewer species of anurans (frogs and toads) than the EAMs, indicating that the young geographical age of the northern volcanoes has not provided enough time for most montane anurans to colonize them. Ancestral-area reconstructions from a dated phylogeny of Brevicipitid frogs throughout the Eastern Afromontane Biodiversity Region indicates the presence of Brevicipitids since the Oligocene, with the central EAMs as the initial center of diversification of the forest species.

3.3.3.2. Birds: A comprehensive avian survey in Boni and Dodori FRs and the area between them identified 185 bird species (two Near Threatened). Bird censuses along permanent transects in four coastal forests of the Pangani-Saadani ecosystem of Tanzania showed that bird abundance was highest in Msumbugwe, the forest with the highest level of human disturbance, while bird species richness and diversity were highest in the least disturbed forests, Kiono/Zaraninge and Kwamsisi/Kwahatibu. A preliminary survey of the bird species composition of the small (ca. 110 ha.) Ikokoto FR in the northeast part of the Udzungwa Mountains reported that all species belonged to the assemblage of species known from the larger Udzungwa forests, 61% of the species were forest dependent, and six species were range-restricted understory taxa; thus this small and highly fragmented forest has significant conservation value for birds.

3.3.3.3. Mammals: Rapid mammal and habitat surveys in Boni and Dodori FRs and the area between them identified five habitat types and their main threats and 26 mammal species and subspecies (one Critically Endangered, four Vulnerable, two Near Threatened). The Kenyan and Tanzanian subpopulations of the East African black-and-white colobus, *Colobus angolensis* subsp. *palliatus*, appear to be evolutionarily distinct, and although the subspecies is currently assessed as Least Concern, its status is being reassessed and seems likely to change. Comparison of the activity budgets of C. *angolensis* subsp. *palliatus* in a coastal forest patch near Shimoni, Kwale District, Kenya, with that of the same subspecies at a more inland site in Tanzania show lower general activity level and smaller group size at Shimoni, suggesting adaptation to lower activity levels due to scarcity of preferred foods under conditions of poor vegetation quality. In various

forest patches in Diani Forest, positional behavior of C. *angolensis* subsp. *palliatus* varies less than activity, strata use, or support use, suggesting that morphology plays a great role than environment in constraining positional behavior.

3.3.3.4. Plants: The African violet genus, *Saintpaulia*, was used as a study system to explain the accumulation of species in tropical montane areas of high biodiversity concentration. Results of the study support the hypothesis of climatically stable montane habitats preventing extinctions in lowland lineages during the Pleistocene, demonstrating the importance of conservation of these habitats for survival of biodiversity in the fact of future climate change.

3.3.4. Policy development (including site, species, and focused issues): Policy recommendations have been formulated based on the results of studies of specific sites and taxonomic groups. For amphibian conservation in the Taita Hills, researchers recommend maintenance of forest fragments together with human modified habitats, habitat connectivity, and replacement of exotic plantations with indigenous plants. Researchers recommend that primate conservation in the Udzungwa Mountains be enhanced by increasing law enforcement at Uzungwa Scarp FR, raising community awareness, establishing livelihood alternatives to bush meat hunting, upgrading the FR to a NR, and restoring connectivity between Uzungwa Scarp FR and PAs to the north. An action plan for conservation in Arabuko-Sokoke Forest emphasizes enhancement of connectivity and quality of habitat and security of elephants while safeguarding against human-elephant conflict. Monitoring of status, pressures, and responses in Kenyan IBAs has produced a set of policy recommendations focused on: mainstreaming of biodiversity into the economy and development plans; continued research and monitoring of IBAs and KBAs including climate change monitoring; measures to check elephant and rhino poaching with outreach to ivory and rhino horn consumers in Asia; resolution of human-wildlife conflict; and building capacity of stakeholders on environmental, social, regulatory, and biodiversity conservation issues. Locally-based monitoring of natural resources and their use can be effective in community management of PAs, but locally-based monitoring must be independently checked to assure that resource use and human disturbance are being accurately reported. Improved enforcement of conservation policies may increase the costs of charcoal and other non-timber forest products and thereby reduce extraction levels, but revenue sharing mechanisms will be needed to avoid

increasing poverty levels and enable communities to benefit from sustainable forest management. The Strategic Environmental Assessment (SEA) process extends the aims and principles of Environmental Impact Assessment (EIA) beyond the project level and aims to integrate environmental considerations into higher levels of decision making. Although regulations in Kenya have directed that all public policies, plans, and programs should be subjected to SEA, the adoption of SEA in Kenya has been delayed due to inadequate expertise. The Kenya Wildlife Service (KWS) is charged with a broad range of conservation, management, and enforcement functions, with fines and terms of imprisonment prescribed for a broad range of offences under the Kenya Wildlife Conservation and Management Act 2013. Community Forest Associations (CFAs) have been formed and sensitized on the Kenya Forest Act 2005 and subsidiary legislation, and have been involved in developing management plans for four coastal forest IBAs. A study of two CFAs in north central Kenya has produced widely applicable policy recommendations for Government involvement in encouraging and mobilizing participation in CFAs, training of CFA members, and ensuring land tenure for sustainable participation and support of PFM in new sites.

3.3.5. Number of sites from which benefits accrue to local communities:

Socioeconomic information on the livelihoods of households and the status of alternative sources of forest products was collected from communities adjacent to eight NRs and one NP in the EAMs of Tanzania. The majority of households around all eight NRs were happy with the conservation status of the NRs, while the majority of households around Udzungwa Mountains NP were not happy with its status due to restrictions to access to forest resources and perceived unfairness of rules and regulations. The Derema Resettlement Action Plan was implemented in five villages around the Derema Forest Corridor to provide financial compensation and alternative livelihood opportunities for displaced farmers, but the intervention failed to mitigate livelihood losses especially among the poorest people. Economic benefits from eco-tourism in 18 villages surrounding Amani NR were minimal and unevenly distributed, with less than one-fourth of households earning any income from eco-tourism. Forest benefits to communities around Arabuko-Sokoke Forest exceed costs in PFM zones, costs exceed benefits in non-PFM zones, and both costs and benefits reduce with distance from the forest. Interventions addressing poverty alleviation in the Boni-Dodori forest ecosystem aim to increase farm yields, enhance food security, and reduce the need to clear more forest for agriculture. The availability of firewood in the Taita Hills has diminished over the last 30 years and the time and energy required for its collection have increased, placing economic stress on households

and underlining the need for new and more sustainable energy sources. The potential impacts of a planned large-scale sugar cane plantation in the Tana River Delta and a large-scale biofuel plantation on the terraces surrounding the delta on water balance and quality and on the environment of the delta were not adequately addressed in the EIA documents, and the proposed projects would have very negative impacts on local community livelihoods through loss of ecosystem services. Carbon REDD projects in the EACF are designed to achieve reductions in carbon dioxide emissions from deforestation and degradation and to ensure the livelihoods of local communities by making them the beneficiaries of sustainable forest management and REDD financing. Formalization and securing of land tenure rights in early phases of REDD project implementation must be coupled with high levels of compliance and enforcement of forest user rules within project boundaries to ensure successful implementation.

4. **Conclusions and Recommendations:** The importance of the EACF continues to be enhanced by research on its biodiversity and conservation status, improved management practices, and mainstreaming of biodiversity into policy. Knowledge gaps that need to be addressed include further study and inventory of EACF biodiversity, expanded monitoring of environmental status and management effectiveness, and improved understanding of resource allocation and benefit sharing by local communities. Programs of *ex situ* propagation and reintroduction into the wild are greatly needed for various rare and threatened taxa such as the Critically Endangered tree *Karomia gigas*. A number of sites in the EACF should be considered for classification as new KBAs, and other sites should be deleted from KBA listing. Policy recommendations formulated by researchers working on specific sites and taxonomic groups should be integrated into policy and management plans.

1.0 Introduction and Background

The Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania (EACF) region (Figure 1.0) is very important due to its biological richness. It is characterized by a high level of species endemism, a severe degree of threat and exceptional diversity of its plant and animal communities, and was thus previously classified as a global biodiversity hotspot by itself (Critical Ecosystem Partnership Fund, 2003), but now lies within two hotspots, the Eastern Afromontane Hotspot and an expanded Coastal Forests of Eastern Africa Hotspot (Mittermeier et al., 2004). In the beginning of the year 2004, the Critical Ecosystem Partnership Fund (CEPF) made a five-year investment of US $7 million allocated to 103 projects in this region. The investment focused on improving human wellbeing and scientific knowledge and reducing the extinction risk for the 333 globally

threatened species then known from the area through improved protection for the sites where these species are found. Beyond this investment, other biodiversity research and conservation work continues in the region due to the interest it attracts. However, efforts to put together and provide the information for wider use by conservation workers, governments, and other stakeholders are still needed. This report is a result of an initiative (funded by a CEPF Consolidation Grant) that is collating data from researchers and from the field against some standard agreed biodiversity monitoring indicators that are used to assess Status, Pressure (threats), and Response (actions) for biodiversity in the EACF.

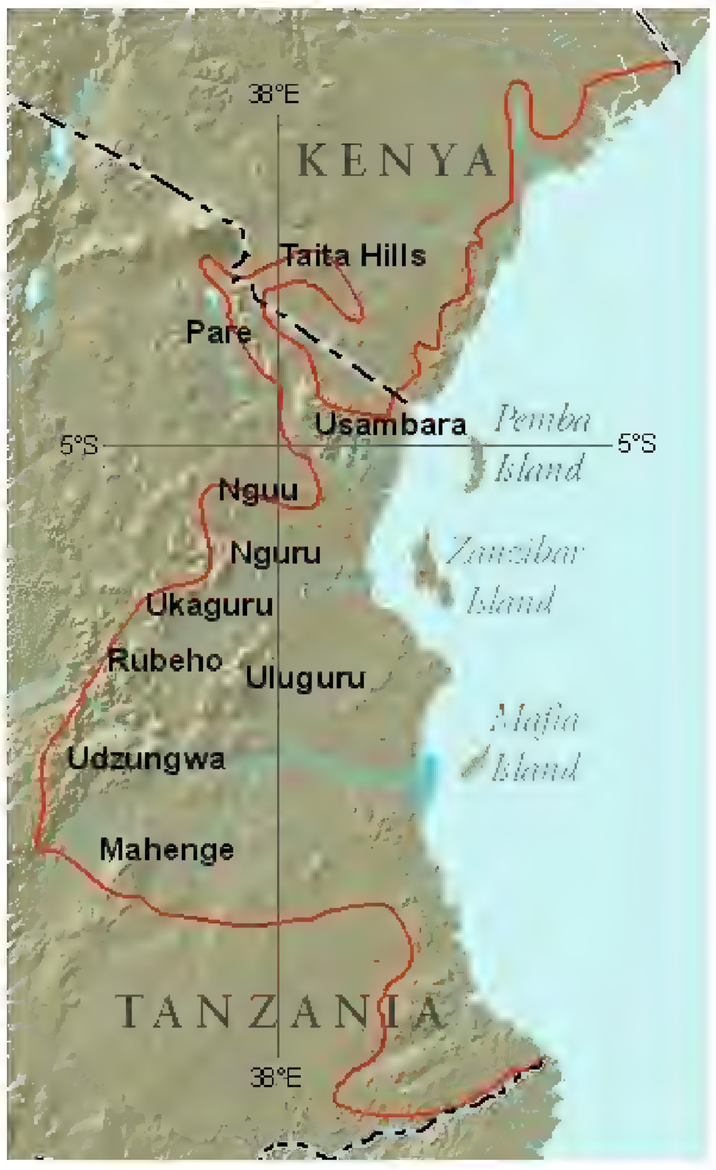


Figure 1.0. The Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania (EACF) Region

This report follows the 2008 and 2012 status and trends reports (Ndang'ang'a *et al.*, 2008; BirdLife International, 2013) and addresses the following:

1. Review of existing reports, publications, online journals, and databases against a set of agreed biodiversity indicators ***(Appendix 1)*** and extraction (into a database) of past and recent data (up to end of 2013/early 2014) for use in preparing a biodiversity status and trends report. Special emphasis is placed in collating data sufficient to build strong cases for the following indicators at Key Biodiversity Areas (KBAs) in the EACF where REDD+ projects are in place or planned.
   Status and changes in:
   (a) Occurrence, distribution and abundance of threatened species,
   (b) Forest quality and health,
   (c) Forest cover,
   (d) Carbon storage,
   (e) Socio-economic co-benefits
2. Filling in of major information gaps in data for the highlighted indicators in 1 (a)

to (e) above.

3. Feeding all collated data into an existing database.

2.0 Approach and Methodology

Prior to the preparation of the 2008 status and trends report for the EACF (Ndang'ang'a et al., 2008), a stakeholder workshop was held in Dar es Salaam in 2005 in which the stakeholders reached consensus and agreed on the following:

i. To institute a collaborative and coordinated approach to biodiversity monitoring based on the pressure-state-response model. Towards the end the stakeholders agreed on a set of 19 indicators (**see** Ndang'ang'a *et al.*, 2008 for details) for the model;
ii. To draw up a list of indicators for monitoring at species, site, and habitat/landscape levels and develop appropriate monitoring tools/frameworks; and
iii. To network among all stakeholders in data gathering, management, sharing, and dissemination.

BirdLife International then took the initiative to enhance the coordinated acquisition, storage, handling, and sharing of biodiversity monitoring data across the EACF region. Towards this effort, in this report the status of biodiversity in the EACF up to 2013 is assessed against the 19 indicators but collapsed since some are overlapping. This review uses the 2008 and 2012 status and trends reports (Ndang'ang'a et al., 2008; BirdLife International, 2013) as the baseline and therefore assesses trends of each of the biodiversity indicators (wherever information exists) building on what was reported in those previous reports. The current report relies largely on collation reports and scientific papers published by various authors between 2008 and 2013 that showed the status and trends of biodiversity in the EACF.

A particular feature of the present report is the greatly expanded coverage of the IUCN Red List (www.iucnredlist.org) for species (and infraspecific taxa) in the EACF. A total of 228 globally threatened taxa (species, subspecies, and varieties) were newly posted on the Red List in 2013, of which 205 were assessments of plant taxa mostly performed by the Eastern African Plant Red List Authority (EAPRLA). The EAPRLA was constituted in 2006 under a grant from CEPF for the primary purpose of assessing the Red List status of plants of the EACF (www.mobot.org/MOBOT/Research/tanzania/cepf2.shtml), and has continued until the present with an expanded coverage in the larger Eastern African region but maintaining a central focus on the EACF (Gereau et al., 2009; Luke et al., 2014). An additional 182 threatened taxa posted on the Red List prior to 2013 had not been included in previous versions of the Outcomes Database, a large proportion of

these being subspecies and varieties of plants, giving a total of 410 globally threatened taxa added to the Outcomes Data base in 2013. Review of these threatened taxa addresses the first State Indicator in the list of monitoring indicators shown in Appendix 1.

3.0 Results

3.1 Status and trends

3.1.1 Forest Quality and Health

The 2012 status and trends report (BirdLife International, 2013) showed significant improvements in Tanzanian coastal forests under Participatory Forest Management (PFM) as measured by reduction of bush meat hunting and increased populations of wild game species in the years 2001-2008. By 2011 there were over 450,000 ha of Tanzanian coastal forest under PFM. At Arabuko-Sokoke Forest in coastal Kenya, PFM areas showed significantly higher measures of forest quality than non-PFM areas. In the Eastern Arc Mountains (EAMs), Preston (2011) demonstrated that PFM is a viable approach to conservation in West Usambara, with particular reference to human disturbance of forests and its effects on primates.

Threats to forest quality within coastal forests include the electric fence constructed to control elephant movements at Arabuko-Sokoke Forest, and uncontrolled charcoal production, pineapple plantations, and shifting cultivation in Dakatcha woodlands (BirdLife International, 2013; Ndang'ang'a, pers. obs.). Hassan et al. (2013) showed that human disturbance in Tanzanian coastal forests impacts negatively on bird species richness and diversity, including Near Threatened and Endangered species. Rocky & Mligo (2012) collected vegetation data using nested plots along transects in both exotic tree plantations and natural forest in Pugu FR and showed an unstable plant population structure in this highly degraded forest, concluding that as a management strategy, clearing natural forests for exotic plantations requires careful monitoring.

Bullock et al. (2014) presented options for the application of sustainable agricultural intensification (SAI) to cardamom agroforestry in the East Usambara Mountains, with soil improvement practices designed to counteract the environmental degradation noted by Hall et al. (2011). Jong (2013) modeled soil erosion to suggest Sustainable Land Management (SLM) measures in West Usambara. Mattee et al. (2013) tested alternative farming practices to improve yields and control soil erosion, and tested tree nursery management and tree planting for watershed rehabilitation in the Uluguru Mountains.

From 2004 to 2011 customized data forms were submitted to the National Museums of Kenya (NMK) and Nature Kenya to assess and assign status, pressure, and response scores for 15 Kenyan coastal forest Important Bird Areas (IBAs) (Ndang'ang'a et al., submitted). Overall, there was no significant change in biodiversity status scores for the assessed IBAs over the monitoring period (Chart 1).

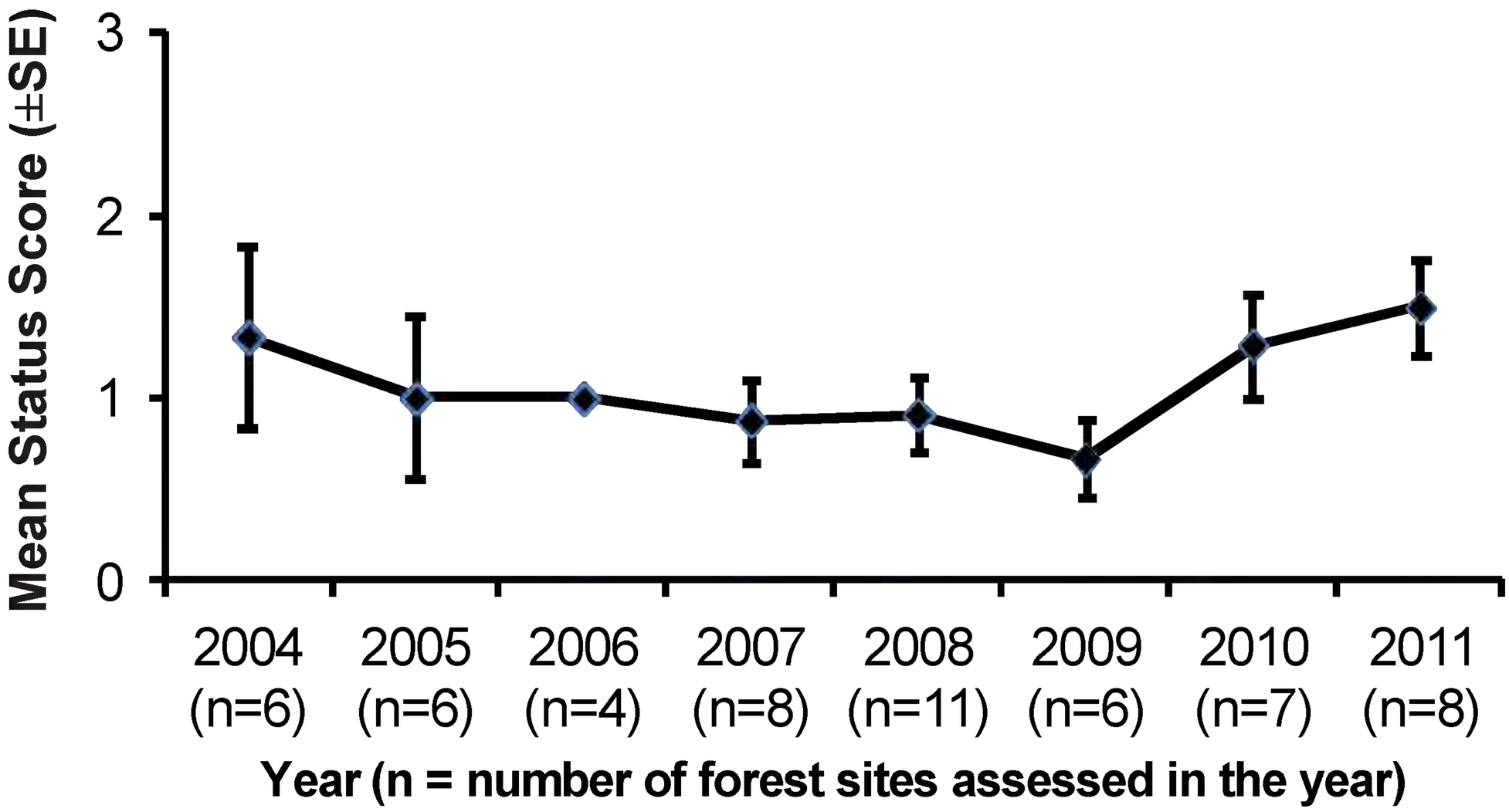


Chart 1: Mean biodiversity status scores for 15 Kenyan coastal forest IBAs from 2004-2011

Arabuko-Sokoke Forest remained in an 'unfavorable' status for all the years assessed; Dakatacha woodlands underwent substantial decline in habitat area and quality; Shimba Hills improved from 'near-favorable' in 2004 to 'favorable' in 2011; Taita Hills was mostly 'unfavorable' in the years assessed; and habitat status in Lower Tana River Forests remained 'unfavorable' throughout the years assessed. Factors contributing to the lack of overall improvement in the state of Kenyan IBAs include: rapid increase in human population with resulting increased demand on resources; new threats resulting from rapid development of infrastructure and energy sources together with agricultural intensification; unsustainable land use practices including biofuel production and excessive pollution; and climate change with negative impacts of prolonged droughts and flooding incidents (Muoria et al., 2013).

EAMCEF (2013) updated information on forest condition in eight Nature Reserves (NRs) and one National Park (NP) in the EAMs of Tanzania, assessing threats and disturbance using circular plots with a radius of 15 m. Five major threats were recorded in these forests: fire, encroachment, illegal tree/pole harvesting, firewood collection, and mining. Forest disturbance was most pronounced in Mkingu NR (Nguru Mountains) and Uluguru

NR, and least in Amani NR and Udzungwa Mountains NP.

3.1.2 Area of different types of forest and degree of fragmentation
3.1.2.1 Forest area

The Global Forest Watch website (www.globalforestwatch.org) generally shows much more tree cover loss than gain in the EACF.

The 2012 status and trends report (BirdLife International, 2013) detailed deforestation rates in Tanzanian coastal forests, with an overall yearly rate of 139.17 km^2/year and highest rates in Pwani and Mtwara Regions. For the years 1995-2010, Kashaigili et al. (2013) documented a decrease in closed forest cover of 25.3% at Pugu FR and 31.3% at Kazimzumbwi FR, mainly due to charcoal burning, logging, encroachment for agriculture, pole cutting, and expansion of farms within the forest. In coastal forests of Kilwa District the primary drivers of forest degradation and deforestation are timber extraction, charcoal, and fire (Miya et al., 2012).

Most studies since 2008 in Kenyan coastal forests show steady forest loss but do not estimate the amount of deforestation (BirdLife International, 2013). Major threats to these forests include illegal charcoal burning, logging, and encroaching agriculture, with large-scale biofuel plantations a potential threat that has been forestalled by the rejection of a development proposal by the National Environment Management Authority (NEMA) (Muoria et al., 2013). Ruuska (2013) found that more than half of the households assessed in the Dakatcha woodland area were involved in charcoal production, and that demand for wood fuels is one of the key drivers of deforestation and land degradation. A land cover classification from satellite images between 2005 and 2011 showed that the woodland is fragmenting and that its IBA demarcation should be reconsidered, a process that Nature Kenya began undertaking in 2014. The Kenya Government is planning a large-scale irrigation project (**www.nib.or.ke/irrigation-programmes**/) within Galana Ranch (in which sections of the Dakatcha IBA are situated) that will have adverse impacts on the ecosystem. In addition, Delmonte, a private international company, intends to secure a significant part of the IBA for pineapple production. Ocholla et al. (2013) demonstrated that salt mining in Magarini District causes deforestation of mangroves and loss of wildlife biodiversity, with possible impacts on nearby Dakatacha woodlands.

Between 1955 and 2004, 50% of indigenous cloud forest in six forest fragments in the Taita Hills was lost to agriculture and bush land (Pellikka et al., 2009). However, between 1985 and 2010, total forest cover in the Taita Hills increased 53%, from 270 km^2 to 414 km^2, although much of this increase can be explained by plantations of exotic trees outside natural forest (Kenya Forest Service, 2013). Ojoyi & Delay (2014) documented losses of montane forest, closed woodland, and grassland in the Nguru Mountains between 1984 and 2000, with a net gain in anthropogenic disturbance (156

km^2) leading to habitat loss and a net gain in cultivated pastures (457 km^2). Based on observed rates of habitat loss in the EAMs between 1975 and 2000, models by Green et al. (2013) predict loss of a further 5% (197 km^2) of forest and 42% (1130 km^2) of woodland by the year 2025.

3.1.2.2 Fragmentation

Kimuyu et al. (2012) showed that the Endangered Tana River crested mangabey, *Cercocebus galeritus,* positively contributes to seed dispersal and regeneration of forest species in habitat gaps in fragmented Tana River gallery forests, thus enhancing their connectivity. Wildlife corridor routes between the Udzungwa Mountains and Selous Game Reserve have become blocked by increased farming and livestock keeping associated with human population growth, but connectivity can be restored, helping to mitigate habitat fragmentation (Jones et al., 2012).

Shirk & Vonesh (2013) used distance-based transects to estimate population densities of three species of chameleons in twelve forest fragments in the East Usambara Mountains to quantify their responses to decreasing forest fragment area. One species showed a strong negative response, with population density greatly decreasing in small habitat patches; one showed a weak negative response; and one species, *Kinyongia vosseleri,* showed a weak positive response, with higher population density in small fragments. Species preferring forest edge habitats may increase in population density as a result of habitat fragmentation, partially counteracting the population decline from habitat loss.

3.1.3 Presence of endemic and globally threatened species, changes in species IUCN Red List category, changes in site status and new species descriptions

3.1.3.1 Presence of endemic and globally threatened species

3.1.3.1.1 Amphibians

The Kihansi spray toad, *Nectophrynoides asperginis,* listed as Extinct in the Wild on the IUCN Red List, was successfully reintroduced into its native habitat in the Uzungwa Scarp FR in October 2012 (https://www.iucn.org/news_homepage/?11673/Kihansi-Spray-Toad-returns-to-the-wild). The Critically Endangered *Nectophrynoides wendyae,* also endemic to the Uzungwa Scarp FR, was reported in 2011 from a second site, 0.5 km from the original site (Seki et al., 2011). Loader et al. (2011) reported range extensions of the Endangered Hidden squeaker frog, *Arthroleptis fichika,* to the North Pare and South Pare Mountains. Furthermore, they showed that the Vulnerable *Arthroleptis tanneri* is endemic to the West Usambara Mountains and extended the range of the Endangered *Hyperolius puncticulatus* to the West Usambara Mountains.

3.1.3.1.2 Birds

The Critically Endangered Long-billed Tailorbird, *Artisornis moreaui*, has been recorded at the Misalai Village landscape (Leonard et al., 2010; BirdLife International, 2013), thus expanding its range to include both Amani and Nilo NRs in the East Usambara Mountains. Borghesio et al. (unpublished: Appendix 2) studied the habitat use of this species and showed that it only occurs inside or along the edges of continuous forest, never in forest fragments, and that its abundance is significantly depressed in sites invaded by the exotic tree *Maesopsis eminii* (Rhamnaceae). The 2012 status and trends report (BirdLife International, 2013) indicated that the Critically Endangered Taita Apalis, *Apalis fuscigularis*, had undergone a major population crash, with a decrease in sighting rates between 2001 and 2010 approaching 80% and a global population of only 60 to 130 individuals, almost all located in a single forest, Ngangao. Between 2009 and 2014, Borghesio et al. (unpublished: Appendix 3) conducted playback surveys that have slightly expanded the known range of the species with previously unreported subpopulations in Msidunyi, Yale, and Mbololo, and a reconfirmed old record in Fururu. However, these range extensions and rediscovery have added fewer than 15 pairs to the total population, and monitoring of the three main subpopulations at Ngangao, Vuria, and Chawia shows a steady decline in range and numbers. The population of the Critically Endangered Taita Thrush, *Turdus helleri*, was estimated at 1,350 individuals in 1997 but is suspected to be in decline due to habitat loss, continuing human disturbance, unsustainable collection of firewood and timber, poaching, and grazing of domestic herbivores in the forest (Muoria et al., 2013). The Vulnerable White-winged Apalis, *Apalis chariessa*, is apparently no longer present in Lower Tana River forests (www.naturekenya.org/content/birds-danger) and thus may be nationally extinct in Kenya, although it remains in the Udzungwa and Uluguru Mountains of Tanzania.

3.1.3.1.3 Insects

A database of dragonfly specimen collections in the EACF (Clausnitzer et al., 2012; Kipping, Clausnitzer & Dijkstra, pers. comm.) expanded the range of the Vulnerable *Coryphagrion grandis* to include six Kenyan coastal forests (Arabuko-Sokoke, Buda, Gongoni, Kaya Muhaka, Kaya Rabai, and the Shimba Hills), and in Tanzania to the East Usambara Mountains, Udzungwa Mountains NP, Kimboza FR, and Pugu FR. The same database revealed the presence of the Vulnerable *Nepogomphoides stuhlmanni* in the East Usambara Mountains and Kimboza FR; expanded the range of the Vulnerable Seychelles fineliner damselfly, *Teinobasis alluaudi*, to Jozani Forest on Zanzibar Island; and showed that the range of the Vulnerable Montane demoiselle, *Umma declivium*, includes the East Usambara, Nguru, Ukaguru, and Uluguru Mountains, as well as Udzungwa Mountains NP.

3.1.3.1.4 Mammals

The Zanzibar Leopard, *Panthera pardus* subsp. *adersi*, is presumed extinct (Siex, 2011), although this subspecies is not included in the taxonomy of *Panthera pardus* shown on the IUCN Red List (http://www.iucnredlist.org/details/15954/0). Based on observations made in 1983 and 1993, the range of the Near Threatened African golden cat, *Caracal aurata*, may extend to Maungu Hills and Arabuko-Sokoke Forest on the Kenya coast, but these observations need confirmation (Butynski et al., 2012). Cordeiro & Seltzer (2012) recorded the presence of the Servaline genet, *Genetta servalina*, in Amani NR in the East Usambara Mountains, but did not identify the subspecies. Lowe's servaline genet, *G. servalina* subsp. *lowei*, occurs in the Udzungwa, Nguru, Uluguru, Rubeho, and Nguu mountains, and although Cordeiro & Seltzer (2012) refer to this subspecies as 'Endangered', the Red List entry for *G. servalina* (http://www.iucnredlist.org/details/41700/0) mentions the subspecies but does not provide an assessment for it. Jones & Bowkett (2012) confirmed the presence of the Endangered Abbot's duiker, *Cephalophus spadix*, in six previously known forest sites in the Udzungwa Mountains and reported the species from three additional sites in the Udzungwas. Mwinami et al. (2013) reported the presence of the Vulnerable Haggard's oribi, *Ourebia ourebi* subsp. *haggardi*, in cultivated areas near Mangai, thus confirming its occurrence in the vicinity of Boni and Dodori National Reserves. Mwinami et al. (2013) also reported Sykes' monkey, *Cercopithecus mitis*, as uncommon in the Boni-Dodori Reserves area, with the Vulnerable Pousargues' Sykes' monkey, C. *mitis* subsp. *albotorquatus*, as the most likely subspecies.

3.1.3.1.5 Plants

Two plant species previously thought to be extinct, the Lake Lutamba coral tree, *Erythrina schliebenii* (Leguminosae) (Figure 2.0), and *Karomia gigas* (Verbenaceae), have been rediscovered in the Namatimbili-Ngarama forest patch located about 35 km inland of Kilwa in southeastern Tanzania (Clarke et al., 2011; BirdLife International, 2013). The EAPRLA has re-assessed both species as Critically Endangered. *Erythrina schliebenii* has been propagated at State House Gardens in Tanzania and President Kikwete ceremonially planted a seedling of this species at State House (Ikulu) on 26 April 2014 as part of the celebration marking Union Day, the 50th anniversary of the unification of Tanganyika and Zanzibar to form the United Republic of Tanzania (http://globaltrees.org/news-blog/tanzania-union-day-tree-planting/) (Figure 3.0).

Figure 2.0. *Erythrina schliebenii*, flower and flower buds
© Cosmas Mligo

Figure 3.0. President Kikwete of Tanzania planting *Erythrina schliebenii* at State House (Ikulu)
© Lenin Festo

3.1.3.2 Changes in species IUCN Red List category

A thorough review of the IUCN Red List (www.iucnredlist.org) revealed 410 globally threatened taxa (species, subspecies, varieties) in the EACF that were not included in the updated Outcomes Database for 2012. Of these 410 taxa, 228 were newly posted on the Red List in 2013, while 182 were first posted on the Red List in previous years (Table 1.0); many of these 182 are infraspecific taxa (subspecies, varieties) that were not included in previous versions of the database. New taxa added to the database in 2013 include some entire Classes of animals (Malacostraca, 4 taxa; Reptilia, 11 taxa) and plants (Liliopsida, 105 taxa; Lycopodiopsida, 1 taxon; Polypodiopsida, 20 taxa).

Table 1.0: New taxon records added in 2013 update of Outcomes Database

Kingdom	Class	Year first published on Red List							
		1998	2008	2009	2010	2011	2012	2013	TOTAL
Animalia	Amphibia		2		1	1	6	4	14
Animalia	Aves						8	3	11
Animalia	Gastropoda				4				4
Animalia	Insecta				3			16	19
Animalia	Malacostraca		4						4
Animalia	Mammalia		7						7
Animalia	Reptilia				9	1	1		11
Plantae	Cycadopsida				2				2
Plantae	Liliopsida	4		26	2		1	72	105
Plantae	Lycopodiopsida							1	1
Plantae	Magnoliopsida	66		29			5	112	212
Plantae	Polypodiopsida							20	20
		70	13	55	21	2	21	228	410

With these additions, the total number of taxa on the 2013 Outcomes Database is 780. However, 24 of this total are "legacy taxa" remaining on the database because they were previously listed in threatened categories (Table 2.0), but have subsequently been downgraded to Near Threatened or Least Concern, resulting in a total of 756 globally threatened taxa in the EACF.

Table 2.0: Taxa on Outcomes Database no longer in threatened Red List categories

Taxon accepted name	Common name	Class	Family	Status 2013
1 *Nectophrynoides tornieri*		Amphibia	Bufonidae	LC
2 *Scolecomorphus vittatus*	Banded Caecilian	Amphibia	Scolecomorphidae	LC
3 *Sheppardia gunningi*	East coast akalat	Aves	Muscicapidae	NT
4 *Zosterops poliogastrus*	Montane white-eye	Aves	Zosteropidae	LC
5 *Lanistes stuhlmanni*		Gastropoda	Ampullaridae	NT
6 *Procolobus rufomitratus*	Tana river red colobus	Mammalia	Cercopithecidae	LC
7 *Atilax paludinosus*	Marsh Mongoose	Mammalia	Herpestidae	LC
8 *Bdeogale jacksoni*	Jackson's mongoose	Mammalia	Herpestidae	NT
9 *Rhynchocyon cirnei*	Checkered sengi	Mammalia	Macroscelididae	NT
10 *Otomops martiensseni*	Large-eared free-tailed bat	Mammalia	Molossidae	NT
11 *Beamys hindei*	Long-tailed pouched rat	Mammalia	Muridae	LC
12 *Dendrohyrax validus*	Eastern tree hyrax/dassie	Mammalia	Procaviidae	LC
13 *Paraxerus palliatus*	Red bush squirrel	Mammalia	Sciuridae	LC
14 *Paraxerus vexillarius*	Swynnerton's bush squirrel	Mammalia	Sciuridae	NT
15 *Crocidura elgonius*	Elgon shrew	Mammalia	Soricidae	LC
16 *Crocidura monax*	Rombo shrew	Mammalia	Soricidae	LC
17 *Crocidura xantippe*	Vermiculate shrew	Mammalia	Soricidae	LC
18 *Lettowianthus stellatus*		Magnoliopsida	Annonaceae	NT
19 *Erythrina sacleuxii*		Magnoliopsida	Leguminosae	NT
20 *Strychnos mellodora*		Magnoliopsida	Loganiaceae	LC
21 *Memecylon greenwayi*		Magnoliopsida	Melastomataceae	LC
22 *Lovoa swynnertonii*		Magnoliopsida	Meliaceae	NT
23 *Trichilia lovettii*		Magnoliopsida	Meliaceae	LC
24 *Mesogyne insignis*		Magnoliopsida	Moraceae	NT

Between 2008 and 2013 a total of 44 taxa in the EACF had their IUCN Red List status changed: 27 between 2008 and 2012, and 17 between 2012 and 2013 (Table 3.0). Of these 44 taxa, 26 were upgraded to higher threat status, 16 were downgraded to lower threat status, and 2 taxa previously assessed as Data Deficient were assigned definite threat status. The Arthroleptid, Brevicipitid, and Microhylid frog species *Leptopelis parkeri*, *L. uluguruensis*, *Probreviceps macrodactylus*, *P. rungwensis*, *P. uluguruensis*, *Hoplophryne rogersi*, and *H. uluguruensis* were all upgraded from a previous threat status of Vulnerable to Endangered due to improved distributional data showing limited Extent of Occurrence and continuing threats to their habitats. The Kihansi spray toad, *Nectophrynoides asperginis*, was upgraded from Critically Endangered to Extinct in the Wild, but, as noted above, has now been successfully reintroduced into its native habitat. The Sagalla Caecilian, *Boulengerula niedeni*, was previously listed as Critically Endangered, but was downgraded to Endangered due to its occurrence in two threat-defined locations; while the Taita African Caecilian, *Boulengerula taitana*, was upgraded from Least Concern to Endangered based on its limited Extent of Occurrence and Area of Occupancy and its occurrence in three threat-defined locations. The freshwater gastropods *Lanistes farleri* and *L. stuhlmanni*, both previously assessed as Endangered, were downgraded to Vulnerable and Near Threatened, respectively, both due to distributional data showing more ample geographic distributions than previously recorded. The Seychelles fineliner damselfly, *Teinobasis alluaudi*, was downgraded from Endangered to Vulnerable in view of its rather broad geographic distribution with a very fragmented and small area of occupancy.

The Udzungwa red colobus, *Procolobus gordonorum*, was upgraded from Vulnerable to Endangered because of its limited extent of occurrence, highly fragmented population, and degradation of its habitat; while the Eastern red colobus, *P. rufomitratus*, was downgraded from Critically Endangered to Least Concern due to the wide African distribution of the species as a whole, although its subspecies the Tana River red colobus, *P. rufomitratus* subsp. *rufomitratus*, is listed as Endangered. The African elephant, *Loxodonta africana*, was upgraded from Near Threatened to Vulnerable because of population reduction with ongoing decline such as habitat loss due to human population expansion that has not ceased and may not be reversible. The Marsh mongoose, *Atilax paludinosus*, was downgraded from Endangered to Least Concern due to its wide distribution range and lack of population decline, and the Long-tailed pouched rat, *Beamys hindei*, was downgraded from Near Threatened to Least Concern for the same reasons. The Geata mouse shrew, *Myosorex geata*, and the Rombo shrew, *Crocidura monax*, were both previously assessed as Data Deficient; with improved distributional data, *M. geata* was assessed as Endangered due to a small Extent of Occurrence and Area of Occupancy with a continuing decline in habitat, and C. *monax* was assessed as Least Concern because of its wide distribution and lack of population decline. The Tanzanian shrew and Howell's shrew, *Crocidura tansaniana* and *Sylvisorex howellii*, were both upgraded from Vulnerable to Endangered because of limited Extent of Occurrence, fragmented distribution, and continuing decline in habitat.

Eight plant taxa were downgraded to lower threat status either because of improved distributional data showing them to be more widespread than previously believed (*Lettowianthus stellatus*, *Erythrina sacleuxii*, *Strychnos mellodora*, *Lovoa swynnertonii*, *Ficus faulkneriana*, *Mesogyne insignis*) or to be well protected throughout their limited ranges (*Memecylon greenwayi*, *Trichilia lovettii*). *Erythrina schliebenii*, previously assessed as Extinct, was reassessed as Critically Endangered following its rediscovery (see above). Thirteen plant taxa were upgraded to higher threat status because of improved data showing them to be highly restricted in distribution with continuing threats to their habitats (*Annickia kummerae*, *Greenwayodendron suaveolens* subsp. *usambaricum*, *Isolona cauliflora*, *Polyceratocarpus scheffleri*, *Toussaintia orientalis*, *Uvariodendron gorgonis*, *Uvariodendron oligocarpum*, *Uvariodendron usambarense*, *Uvariopsis bisexualis*, *Schefflera lukwangulensis*, *Millettia micans*, *Lijndenia brenanii*, *Afrocarpus usambarensis*).

Table 3.0: List of taxa whose IUCN Red List status changed between 2008 and 2013

	Taxon accepted name	Class	Family	Status 2008	Status 2009	Status 2010	Status 2011	Status 2012	Status 2013
1	*Leptopelis parkeri*	Amphibia	Arthroleptidae	VU	VU	VU	VU	VU	EN
2	*Leptopelis uluguruensis*	Amphibia	Arthroleptidae	VU	VU	VU	VU	VU	EN
3	*Probreviceps macrodactylus*	Amphibia	Brevicipitidae	VU	VU	VU	VU	VU	EN
4	*Probreviceps rungwensis*	Amphibia	Brevicipitidae	VU	VU	VU	VU	VU	EN
5	*Probreviceps uluguruensis*	Amphibia	Brevicipitidae	VU	VU	VU	VU	VU	EN
6	*Nectophrynoides asperginis*	Amphibia	Bufonidae	CR	EW	EW	EW	EW	EW
7	*Boulengerula niedeni*	Amphibia	Herpelidae	CR	CR	CR	CR	CR	EN
8	*Boulengerula taitana*	Amphibia	Herpelidae	LC	LC	LC	LC	LC	EN
9	*Hoplophryne rogersi*	Amphibia	Microhylidae	VU	EN	EN	EN	EN	EN
10	*Hoplophryne uluguruensis*	Amphibia	Microhylidae	VU	VU	VU	VU	VU	EN
11	*Lanistes farleri*	Gastropoda	Ampullaridae	EN	EN	VU	VU	VU	VU
12	*Lanistes stuhlmanni*	Gastropoda	Ampullaridae	EN	EN	NT	NT	NT	NT
13	*Teinobasis alluaudi*	Insecta	Coenagrionidae	EN	VU	VU	VU	VU	VU
14	*Procolobus gordonorum*	Mammalia	Cercopithecidae	VU	EN	EN	EN	EN	EN
15	*Procolobus rufomitratus*	Mammalia	Cercopithecidae	CR	LC	LC	LC	LC	LC
16	*Loxodonta africana*	Mammalia	Elephantidae	NT	VU	VU	VU	VU	VU
17	*Atilax paludinosus*	Mammalia	Herpestidae	EN	LC	LC	LC	LC	LC
18	*Beamys hindei*	Mammalia	Muridae	NT	LC	LC	LC	LC	LC
19	*Myosorex geata*	Mammalia	Soricidae	DD	EN	EN	EN	EN	EN
20	*Crocidura monax*	Mammalia	Soricidae	DD	LC	LC	LC	LC	LC

	Taxon accepted name	Class	Family	Status 2008	Status 2009	Status 2010	Status 2011	Status 2012	Status 2013
21	*Crocidura tansaniana*	Mammalia	Soricidae	VU	EN	EN	EN	EN	EN
22	*Sylvisorex howelli*	Mammalia	Soricidae	VU	EN	EN	EN	EN	EN
23	*Annickia kummerae*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
24	*Greenwayodendron suaveolens* subsp. *usambaricum*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
25	*Isolona cauliflora*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
26	*Lettowianthus stellatus*	Magnoliopsida	Annonaceae	VU	NT	NT	NT	NT	NT
27	*Polyceratocarpus scheffleri*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
28	*Toussaintia orientalis*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
29	*Uvariodendron gorgonis*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
30	*Uvariodendron oligocarpum*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
31	*Uvariodendron usambarense*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
32	*Uvariopsis bisexualis*	Magnoliopsida	Annonaceae	VU	EN	EN	EN	EN	EN
33	*Schefflera lukwangulensis*	Magnoliopsida	Araliaceae	VU	EN	EN	EN	EN	EN
34	*Erythrina sadeuxii*	Magnoliopsida	Leguminosae	VU	VU	VU	VU	NT	NT
35	*Erythrina schliebenii*	Magnoliopsida	Leguminosae	EX	EX	EX	EX	CR	CR
36	*Millettia micans*	Magnoliopsida	Leguminosae	VU	VU	VU	VU	VU	EN
37	*Strychnos mellodora*	Magnoliopsida	Loganiaceae	VU	VU	VU	VU	VU	LC
38	*Lijndenia brenanii*	Magnoliopsida	Melastomataceae	VU	VU	VU	VU	VU	CR
39	*Memecylon greenwayi*	Magnoliopsida	Melastomataceae	VU	VU	VU	VU	VU	LC
40	*Lovoa swynnertonii*	Magnoliopsida	Meliaceae	EN	EN	EN	EN	EN	NT
41	*Trichilia lovettii*	Magnoliopsida	Meliaceae	VU	VU	VU	VU	VU	LC
42	*Ficus faulkneriana*	Magnoliopsida	Moraceae	CR	CR	CR	CR	CR	VU
43	*Mesogyne insignis*	Magnoliopsida	Moraceae	VU	VU	VU	VU	VU	NT
44	*Afrocarpus usambarensis*	Pinopsida	Podocarpaceae	VU	VU	VU	VU	VU	EN

3.1.3.3 Changes in site status

A total of 1,419 new distribution records were added to the Outcomes Database in 2013, consisting of 1,162 records for the 410 taxa newly added to the database and 257 records for taxa previously listed on the database. Distribution records for plant taxa were derived from the TROPICOS© database of the Missouri Botanical Garden (www.tropicos.org) and the database of the EAPRLA.

Comparing the 2012 and 2013 Outcomes Database, many changes in the numbers of threatened taxa reported from 173 sites within the EACF have resulted from the new distribution records of previously known and newly added threatened taxa together with the loss of taxa no longer listed in threatened categories (Appendix 4). A total of 100 sites showed a net gain in threatened taxa, while 62 sites had no net change, and 11 sites had a net loss, although no single site showed a net loss of more than two taxa. The Uluguru Mountains had the largest net gain (101 taxa), followed by West Usambara (93), Udzungwa (excluding Udzungwa Mountains NP) (82), East Usambara (70), and Nguru (61). Only sites with a relatively small number of threatened taxa showed a net loss: e.g., Jozani FR (Zanzibar) and Newala District coastal forests (Tanzania), both with a loss of one taxon and a 2013 total of 9 threatened taxa. In 2013, the Uluguru Mountains had the largest number of threatened taxa (197), followed by East Usambara (187), West Usambara (165), Udzungwa (excluding UMNP) (161), and Udzungwa Mountains NP (136).

Based on these changes in numbers of threatened taxa by site, 17 sites in the EACF not previously classified as KBAs may now qualify as such due to the presence of globally threatened taxa. These are:

1. Lamu District (Kenya) coastal forests (e.g. Haiwani Forest, Kanwe Mayi, Kiunga, Kiwayu, Kui Island, Lake Mukunguya, Lamu Island, Nairobi Ranch, Ras ya Mwana, Shamba Ziwa, Utwani FR): 28 taxa
2. Kilifi District (Kenya) coastal forests (e.g. Bamba, Bonje Village, Dakawachu, Giriama, Gotani North, Kachararoni Gorge, Kaya Fimboni, Kikambala, Malindi, Mida, Mwahera, Vitengeni River): 26 taxa
3. Kwale District (Kenya) coastal forests (e.g. Golini, Kilibasi, Duruma, Jego, Mackinnon Road, Mkongani West, Mukurumudzi, Taru, Vigurangani): 22 taxa
4. Mahenge (areas not otherwise specified, e.g. Igundalamlungu, Issongo, Isyaga Village, Muhulu Mts., Mzelezi FR, Nawenge FR, Ndororo Mt.): 19 taxa
5. Mtwara District (Tanzania) coastal forests (e.g. Mahurunga, Mkunya River proposed FR, Mtiniko, Nyangarama, Ruvuma Bay): 9 taxa
6. Tanga District (Tanzania) coast (e.g. Amboni Caves, Kange Gorge, Kwamba FR, Steinbruch Gorge, Tanga): 9 taxa
7. Masasi District (Tanzania) forests (e.g. Chidya, Chiwata Ngatala Rock, Kwa-Mkopo, Mbangala River, Ndanda Mission, Pangani Hill): 8 taxa

8. Mombasa coast (e.g. Changamwe, Gazi, Likoni, Nyali Beach, Port Tudor, Shanzu Beach, Shimo la Tewa): 7 taxa
9. Mahenge (Nambiga FR): 5 taxa
10. Taita District (Kenya) coastal forests (e.g. Kizima [Kirima] Hill, Lake Kandere [Kandiri], Lumi River, Taveta): 5 taxa
11. Kaya Timbwa (Kenya): 2 taxa
12. Malundwe (Tanzania): 2 taxa
13. Nachingwea District (Tanzania): 2 taxa
14. Kaya Bura (Kenya): 1 taxon
15. Kisiju Island (Tanzania): 1 taxon
16. Kyngani River (Tanzania): 1 taxon
17. Ruangwa District (Tanzania) coastal forests: 1 taxon

In addition to the above, five wide-ranging bird species with geographic ranges potentially including all of the EACF were not assignable to specific sites and were thus classified as "Widespread in EACF"; these are the Endangered White-backed Vulture, *Gyps africanus*, and Hooded Vulture, *Necrosyrtes monachus*, and the Vulnerable Southern Ground Hornbill, *Bucorvus leadbeateri*, Martial Eagle, *Polemaetus bellicosus*, and Secretary Bird, *Sagittarius serpentarius*. The site "Southeast coastal Kenya" includes only the Vulnerable Gastropod species *Lanistes ciliatus*, with range cited as "between Mombasa and Taita" with no further information (http://www.iucnredlist.org/details/11281/0).

Tumbatu Island (Tanzania) has been considered a KBA due to the presence of the Eastern tree hyrax, *Dendrohyrax validus*, which was listed as Vulnerable on the IUCN Red List until its re-assessment as Least Concern in 2006. With the loss of its only globally threatened species, the KBA status of Tumbatu Island should be reconsidered.

Seven other sites currently listed as KBAs have no threatened taxa on the 2013 Outcomes Database. Bungu FR has been merged into West Usambara, Lango ya Simba into Lower Tana River forests, and Mikindani (Mnima) into Lindi (Mkindani). Latham Island, Mtwara, Tanga North-Kibo Salt Pans, and Tanga South had no threatened taxa listed on the 2012 Outcomes Database, and still have none in 2013. The KBA status of all these sites should be reconsidered.

3.1.3.4 New species descriptions

Loader et al. (2011) described *Arthroleptis anotis*, a new frog species endemic to Chome FR in the South Pare Mountains. The 2012 status and trends report (BirdLife International, 2013) listed 19 new herpetofauna species described from the South Nguru Mountains, Tanzania, and indicated new species yet to be named including *Nectophrynoides* species, one gecko species, and species of tree frogs, forest snakes, and chameleons.

A new sengi species, *Rhynchocyon udzungwensis*, was described from the Udzungwa Mountains in 2008, and another possible new species of *Rhynchocyon* was reported in Boni and Dodori forests in 2010 (BirdLife International, 2013).

Chase et al. (2013) described *Dorstenia christenhuizii* (Moraceae), a new plant species endemic to Mbololo Hill in the Taita Hills of Kenya, also the only known locality of the endemic *Saintpaulia teitensis* (Gesneriaceae).

3.1.4 Percentage of area within protected areas

The 2012 status and trends report (BirdLife International, 2013) documented an increase in the percentage of the EACF within PAs due to the gazettement in 2010 of Derema FR in the East Usambara Mountains (968 ha). In 2011 this percentage was further increased by the establishment of two village FRs in the Rubeho Mountains (1,048 ha); twelve village FRs in Kilwa District (90,900 ha); ten village FRs in Lindi Rural District covering 33,726 ha of coastal forest and woodland including much of the Noto and Chitoa plateaux (Doggart, 2014); one community FR (94 ha) in Misalai Village in the East Usambara Mountains; three village FRs in the lowland South Ngurus (2,334 ha); and 16 village FRs in the Rubeho and Ukaguru Mountains covering 114,729 ha of Eastern Arc forest and woodland (Burgess, pers. comm.).

In a detailed analysis of eight NRs and one NP in the EAMs of Tanzania, EAMCEF (2013) did not report any change in the boundaries or area covered by these PAs.

The percentage of area within PAs in the EACF did not change in 2013. However, the level of available knowledge of the biodiversity of the various PAs is extremely uneven. Gereau & Kindeketa (2014) mapped 72,046 geo-referenced Tanzanian herbarium specimens and showed that 285 PAs in Tanzania have no specimen collections in the principal national, regional, and international institutions. These uncollected PAs represent a total surface area of 42,033 km^2, or 4.4% of the surface area of the entire country. In the Regions and Districts of Tanzania containing the EACF, 124 PAs representing a surface area of 6,680 km^2 have no specimen collections and their plant diversity thus remains unknown (Figure 4.0, Appendix 5).

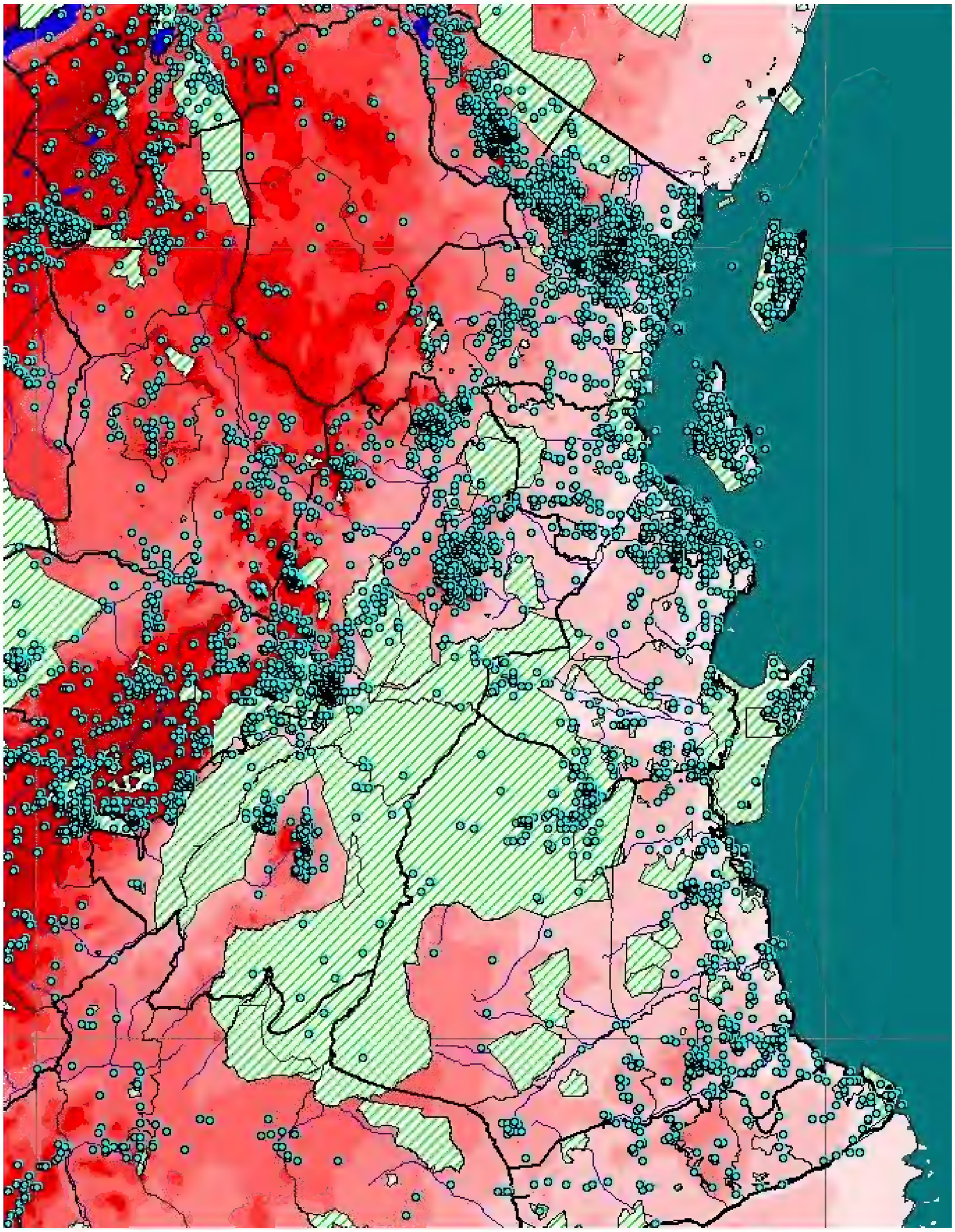


Figure 4.0. Tanzanian herbarium specimen locations (light blue dots) overlain on the EACF protected area network (diagonally hatched polygons).

3.1.5 Carbon storage

Itkonen (2012) quantified aboveground biomass and carbon sequestration capacity for twelve forests of the Taita Hills by empirical modelling using satellite imagery. Omoro et al. (2013) determined biomass carbon (C) and soil organic carbon (SOC) densities for four high-elevation forested areas in the Taita Hills and found that mean total biomass C and SOC densities for indigenous forests were significantly greater than those of

plantations of exotic tree species.

EAMCEF (2013) determined carbon loss due to deforestation in eight NRs and one NP in the EAMs of Tanzania. The carbon loss in montane forests in the period between 1999/2003 and 2010/2011 for the various PAs is: Amani NR - 31,247 tons/year; Mkingu NR - 13,162 tons/year; Nilo NR - 7,906 tons/year; Chome NR - 1,693 tons/year; Magamba NR - 528 tons/year; Kilombero NR - 177 tons/year; Uzungwa Scarp NR - 158 tons/year. Uluguru NR and Udzungwa Mountains NP had no carbon loss in this period.

Willcock et al. (2012) presented a method to estimate carbon storage values for all five IPCC carbon pools (aboveground live carbon, litter, coarse woody debris, belowground live carbon, and soil carbon) and applied it over the entire watershed of the EAMs, covering 339,000 km^2. They estimated that the area stored 6.33 Pg of carbon in the year 2000, much higher than the estimates of most previous studies of the area. The EAM sub-montane forest contains the most aboveground live carbon per unit area, followed by montane forest, lowland forest, upper montane forest, and forest mosaic. Burgess et al. (2010a) estimated carbon loss up to the year 2000 in EAM forests and East African coastal forest mosaics and provided percentage estimates of total carbon emissions per annum in coastal areas of Tanzania, as summarized in the 2012 status and trends report (BirdLife International, 2013). Godoy et al. (2011) estimated a total of 17 Mt carbon stored in the remaining coastal forests of Tanzania in 2007, with carbon dioxide gross emissions from forest clear-cutting in the area at 0.63 Mt per year during the 1990s and 0.20 Mt per year during 2000-2007.

Kashaigili et al. (2013) estimated aboveground carbon stock in Pugu FR at 14,730 tons/ha and in Kazimzumbwi FR at 7,206 tons/ha, with low carbon densities attributable to decline in area under closed forest in the two Reserves during the period 1995-2010. Mngumi et al. (2013) found low levels of interest in and acceptance of a REDD+ initiative at Pugu and Kazimzumbwi FR, dimming the prospects for developing a solution to this situation.

In the Kenyan coastal forests, carbon assessments have been done only for Arabuko-Sokoke Forest, with major losses in both forest cover and terrestrial carbon stock in the adjoining Madungini Forest (BirdLife International, 2013).

3.2 Pressure

3.2.1 Pressure/threat scores for Kenyan IBAs

Mean pressure scores for 15 Kenyan coastal forest IBAs varied significantly over the years 2004-2011, with the lowest pressure score in 2006 and the highest in 2008 (Ndang'ang'a et al., submitted) (Chart 2). Poaching for bush meat was a threat to

Arabuko-Sokoke Forest. Firewood collection was a threat to Arabuko-Sokoke Forest, Taita Hills, and Lower Tana River Forests; while selective logging was a threat to Arabuko-Sokoke Forest, Dakatcha woodlands, Shimba Hills, Taita Hills, and Lower Tana River Forests. Charcoal burning was a threat to Dakatcha woodlands and Taita Hills. Agricultural clearing and encroachment were a particularly severe pressure in Dakatcha woodlands and Shimba Hills, and Taita Hills; and fire in both grasslands and forest seriously impacted Shimba Hills, Taita Hills, and Lower Tana River Forests. Overall, the level of threats facing Kenyan IBAs rose significantly between 2004 and 2011, driven primarily by the rapidly expanding human population and to some extent by climate change and rapid infrastructural development (Muoria et al., 2013).

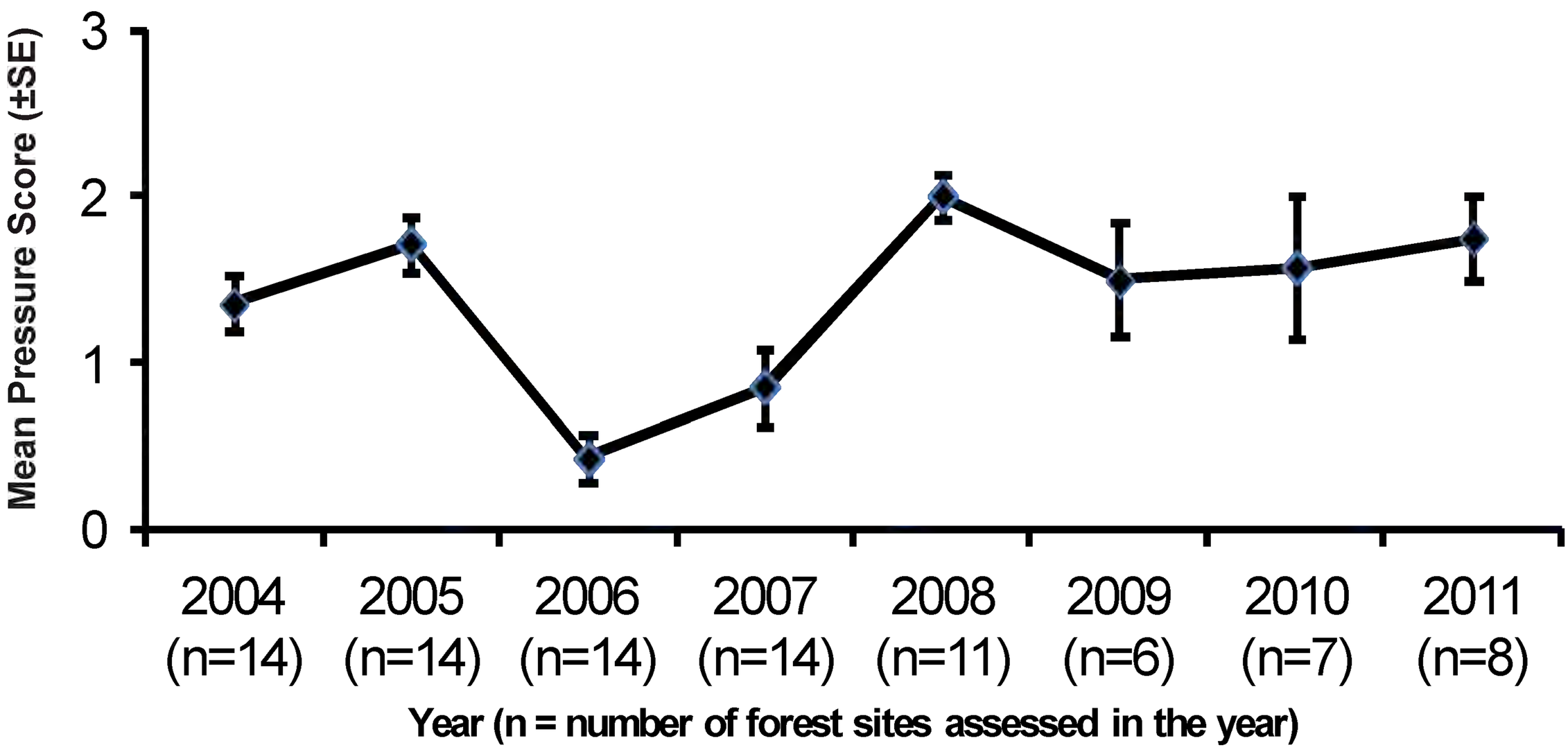


Chart 2: Mean pressure scores for 15 Kenyan coastal forest IBAs from 2004-2011

3.2.2 Change in extraction intensity of key species

Miya et al. (2012) indicated that the primary drivers of forest degradation and deforestation in Kilwa District, Tanzania are timber extraction, charcoal burning, and fire. Among the tree species most strongly affected by these factors, only the Vulnerable African/White mahogany, *Khaya anthotheca,* is globally threatened, and is among the most harvested timber species in the villages surveyed. However, a number of these heavily impacted species are ecologically important for maintenance of the structure and integrity of their vegetation communities and/or are under considerable environmental pressure without rising to the level of being globally threatened. The Near Threatened African blackwood ("Mpingo" in Swahili), *Dalbergia melanoxylon,* is heavily

extracted for artisanal carvings and manufacture of musical instruments. The Near Threatened Bleedwood tree ("Mninga" in Swahili), *Pterocarpus angolensis,* is among the most harvested timber species, as is the Near Threatened Mvule (Swahili), *Milicia excelsa*. The Near Threatened *Brachylaena huillensis* is among the tree species most preferred for charcoal, and its wood is also heavily exploited in the wood carving industries of Kenya and Tanzania (http://www.iucnredlist.org/details/33474/0). The dominant trees in Miombo woodland, species of *Brachystegia* and *Julbernardia,* are fire-sensitive at young age, and regular fire tends to decrease their number and thus alter the vegetation structure; *Julbernardia globiflora* is also among the species most preferred for charcoal. In Kilengwe Forest, a forest in Morogoro Rural District that is dominated by *J. globiflora,* many of these same species (*Khaya anthotheca, Dalbergia melanoxylon, Milicia excelsa*) are logged below their minimum required harvestable diameter (Kacholi, 2014).

Schaafsma et al. (2013) used market surveys and household census data to estimate extraction volumes of timber from the EAMs of Tanzania, and found clear signs of unsustainable hardwood harvesting. Using the timber classification by Ahrends (2011), they showed that in class I (the highest quality species), the Vulnerable African/White mahogany, *Khaya anthotheca,* is particularly difficult for carpenters, sawyers, and dealers to obtain, as are the Near Threatened Bleedwood tree, *Pterocarpus angolensis*, and Mvule, *Milicia excelsa*. In class II, the Endangered *Afrocarpus usambarensis* is increasingly scarce. Data on charcoal production in the EAMs of Tanzania (Schaafsma et al., 2012) show a similar potential contribution to forest degradation, but without an explicit analysis of the species involved.

Nielsen et al. (2014) conducted an experiment asking respondents in the Kilombero Valley to choose between hunting or trading of bush meat and alternative salary-paying work in a set of hypothetical scenarios to determine the conditions under which they would change their current occupations. Economic considerations (donation of livestock, price of substitute meat, salary of alternative occupation) significantly outweighed the effect of costly enforcement measures (wildlife patrol frequency, size of fines), indicating that the creation of better alternative economic activities is a more cost-effective means of reducing poaching than punitive measures. These are important considerations in the Kilombero Valley, which has seen substantial declines of the Vulnerable Common hippopotamus, *Hippopotamus amphibius*, and the Vulnerable African elephant, *Loxodonta africana*, as well as the Puku antelope, *Kobus vardoni*, which is scattered throughout eastern and central Africa but with an estimated 75% of its total population restricted to the Kilombero Valley (Jenkins et al., 2003).

Rovero et al. (2012) contrasted the population relative abundance of diurnal primates in two forest blocks in the Udzungwa Mountains, one in Udzungwa Mountains NP that is regularly patrolled by NP rangers, and one in Uzungwa Scarp FR that lacks any law enforcement measures on the ground. The five species studied included the Endangered

Udzungwa red colobus, *Procolobus gordonorum*, and the Endangered Sanje mangabey, *Cercocebus sanjei*. They measured how abundance changed between 2004 and 2009, assessed habitat and disturbance parameters, and evaluated hunting practices in the unprotected forest. They found that increased hunting in the unprotected forest has greatly reduced the population of the canopy-dwelling colobine monkeys (*P. gordonorum* and *Colobus angolensis* subsp. *palliatus*), with some possible additional negative effect from habitat degradation, while the more ecologically adaptable cercopithecine monkeys (*Cercocebus sanjei* and Sykes' monkey, *Cercopithecus mitis*) were more abundant in the unprotected forest and did not decline significantly.

Ruuska (2013) reported that more than 40 tree species are used as firewood and charcoal in Dakatcha woodlands, and although the most commonly used species are not globally threatened with extinction, unsustainable charcoal production is a major factor in the decline of forest cover and habitat fragmentation in this area, with concentrations of thickets of the Vulnerable *Cynometra webberi* and woodlands of *Brachystegia spiciformis* no longer coinciding with the boundaries of the IBA on the site. The Endangered Clarke's weaver, *Ploceus golandi*, is known only from Dakatcha woodland and Arabuko-Sokoke Forest; the *Brachystegia* woodland at Dakatcha was previously considered to be the main breeding site for this species (Nature Kenya, 2008; Ruuska, 2013), but Ng'weno (2013) clarified that the birds are breeding in seasonal wetlands at Dakatcha. Other threatened species in Dakatcha woodlands likely to be impacted by forest degradation and habitat fragmentation are the Endangered Sokoke pipit, *Anthus sokokensis*, and the Vulnerable Sokoke scops owl, *Otus ireneae*, as well as the Vulnerable shrub *Pavetta linearifolia* and the Vulnerable Bushy-tailed mongoose, *Bdeogale omnivora*. Unsustainable hunting for commercial and subsistence use has contributed to the localized change in status of other threatened species of Kenyan coastal forests, such as the Critically Endangered Ader's duiker, *Cephalophus adersi*, and the Endangered Golden-rumped sengi, *Rhynchocyon chrysopygus* (BirdLife International, 2013).

Dakatcha woodlands cleared for agriculture
© Mercy Kariuki

3.2.3 Changes in human population density in wards, divisions in the EACF

Lindi Region in southeastern Tanzania has a surface area of 67,000 km^2 (Miya et al., 2012) and, according to the census of 2012, a human population of 864,652 (www.nbs.go.tz). With an overall population density of ca. 13 individuals/km^2 the Region is sparsely populated; however the population is more concentrated in the areas outside the Selous Game Reserve, which occupies 18,000 km^2 of the Region. Kilwa District, the most northerly District in Lindi Region, has a land area of 12,126 km^2 and, according to the 2012 census, a human population of 190,744, giving a population density of ca. 16 individuals/km^2. Although Miya et al. (2012) did not present District-wide population levels for earlier dates, the annual growth rate is 2.4% and between 2002 and 2010 the populations of six surveyed villages increased by up to 57%. Thus, even with a low overall population density, population growth is resulting in rapid agricultural expansion and consequent forest clearing to place more land under shifting cultivation. Residents of villages with PFM in place have begun to understand the need to farm permanent plots or re-use abandoned fields, whereas residents of villages without PFM continue to clear forests in order to maximize short-term yields (Miya et al., 2012).

The 2012 status and trends report (BirdLife International, 2013) documented the human population increase in Malindi County, Kenya, as a causal factor in the degradation of Dakatcha woodland and loss of biodiversity due to increased hunting pressure. Agricultural expansion driven by population growth is a key factor in the disappearance of unprotected forest habitats within the EAMs and the degradation and destruction of both protected and unprotected areas on the Kenya and Tanzania coast. All parts of Zanzibar and Pemba are severely threatened by very high human population density, with an estimated 5% annual growth rate.

3.2.4 Presence and coverage of invasive species

Burgess et al. (2010b) identified the 20 vascular plant species that are invasive in the EAMs of Tanzania, as summarized in the 2012 status and trends report (BirdLife International, 2013). EAMCEF (2013) reported serious invasive species problems at Amani NR and Udzungwa Mountains NP involving species listed by Burgess et al. (2010b), with the addition of Common bamboo, *Bambusa vulgaris*, and the Asian bramble, *Rubus niveus*. *Maesopsis eminii* is the most serious threat to Amani NR. Borghesio (2012) showed that invasion by *M. eminii* has a differential effect on common and rare bird species in the East Usambara Mountains, with no significant effect on the frequency of the nine commonest forest bird species, but with highly significant negative effects on frequency for five out of eleven rare bird species, including the Critically Endangered Long-billed tailorbird, *Artisornis moreaui*, and the Near Threatened Fischer's turaco, *Tauraco fischeri*.

In Kenya's coastal forests, there has been a dramatic spread of *Prosopis juliflora*,

especially in the Tana River Delta, and the Neem tree, *Azaridachta indica*, has spread by seeds to become invasive in parts of coastal Kenya and Tanzania (BirdLife International, 2013).

3.2.5 Fire frequency

EAMCEF (2013) reported forest fire as a major threat in all of eight NRs and one NP in the EAMs of Tanzania. No explicit data on fire frequency were presented, but there was a general decline in fire along the forest edge in Chome NR, and the fire problems seemed to have been significantly contained in Magamba NR. In much of Kilwa District, Tanzania, Miya et al. (2012) reported a fire frequency of 1-3 years in coastal forest and woodland, with annual fire converting miombo woodland to grassland; under less frequent fire regimes, maintenance of forest cover depends on fire intensity, with low intensity fires allowing forest cover to be maintained even with a fire return interval of two years.

3.3 Response Indicators

3.3.1 Response scores for Kenyan IBAs

Response scores for 15 Kenyan coastal forest IBAs showed a significant annual variation over the years 2004-2011 (Ndang'ang'a et al., submitted) (Chart 3). Law enforcement measures brought about some improvements in Arabuko-Sokoke Forest, Shimba Hills,

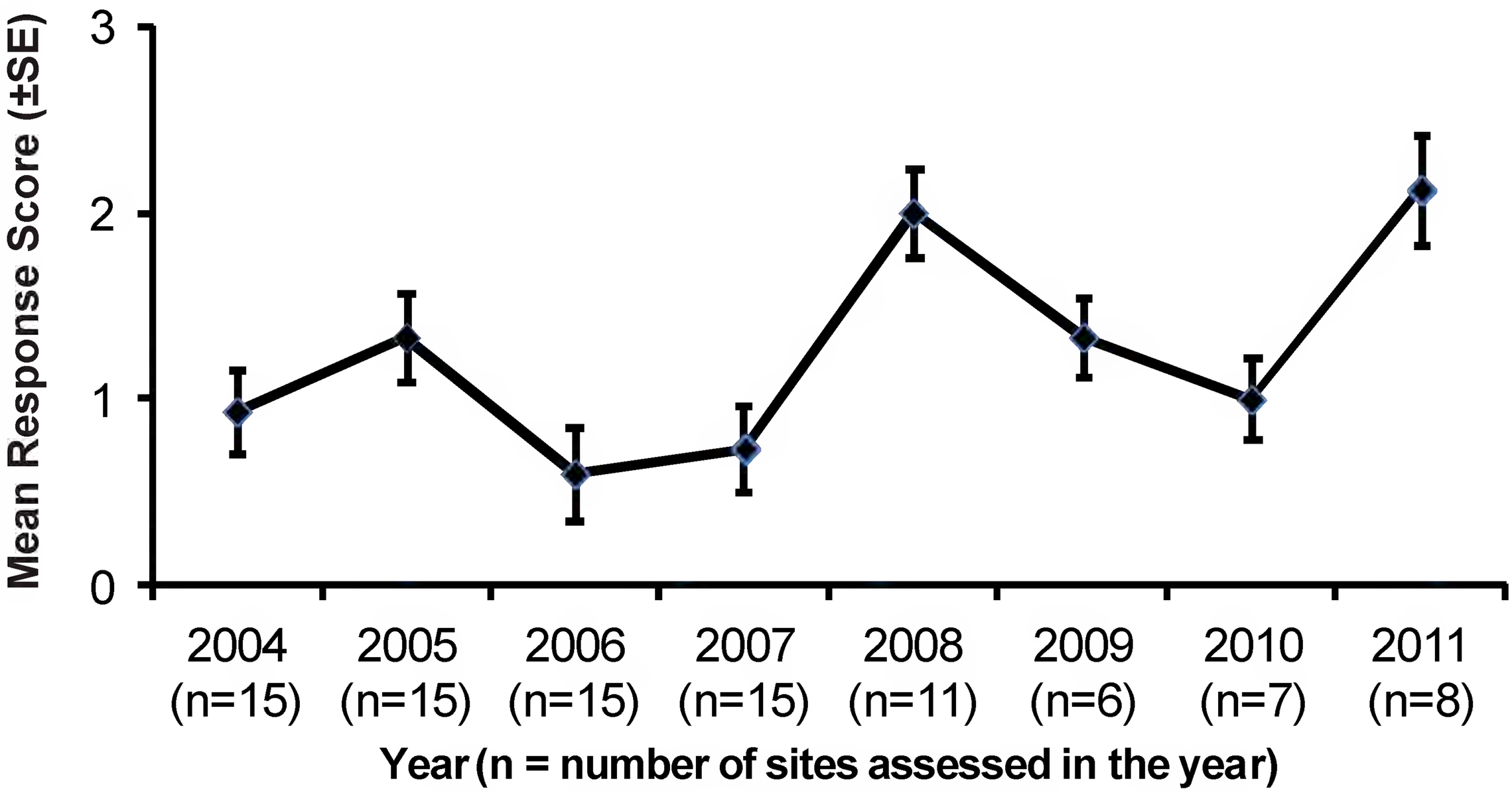


Chart 3: Mean response scores for 15 Kenyan coastal forest IBAs from 2004-2011

and Taita Hills, while response scores remained low in Dakatcha woodlands due to lack of legal protection status. Nature Kenya has been implementing donor funded conservation projects in Dakatcha woodland and Taita Hills forests, and the Community Development Trust Fund (CDTF) supported community based organizations (CBOs) in the Taita Hills forests and Arabuko-Sokoke Forest to take action for biodiversity conservation in 2011 (Muoria et al., 2013).

3.3.2 Changes in forest management effectiveness

The 2012 status and trends report (BirdLife International, 2013) summarized results of application of the World Commission on Protected Areas (WCPA) Management Effectiveness Tracking Tool, METT (Hockings et al., 2006), to 397 forest sites within the EACF between 2004 and 2012. METT was used to evaluate 183 PAs in the EAMs of Tanzania in 2004; 49 sites in Kenya in 2006; 11 Kenyan coastal forests (mostly kayas) in 2008; 18 PAs in the EAMs of Tanzania in 2009; the Taita Hills in 2012; and 146 PAs across the coastal forests of Tanzania in 2012 (Burgess et al., 2012). As a follow-up study to the survey of 49 sites in Kenya in 2006, the survey of eleven Kenyan coastal forest in 2008 showed a decline in management effectiveness at four sites and an improvement at two sites. METT scores varied widely, with private forests in the EAMs of Tanzania showing better management effectiveness than government FRs and village forests in the 2004 survey, but with state-owned forests in Kenya having higher scores. In the Tanzanian coastal forests, the best managed PAs were NPs and village land FRs managed at the village level, while National and Local Authority FRs had weak management effectiveness.

In 2013 a team from WWF Tanzania completed the GEF Biodiversity Tracking Tool (www.thegef.org/gef/BD_tracking_tool) to calculate METT scores for 27 Tanzanian coastal forests, considering 30 main issues to arrive at a final score for each (WWF Tanzania, unpublished data). Three of the forests had METT scores in the range considered Poor (0-30%); 15 were Average (31-45%); five were Good (46-60%); and four were Very Good (>60%). The three Poor scores were for National and Local Authority FRs in the Kilwa, Lindi/Rondo, and Rufiji landscapes. The five Good scores were for one Local Authority FR in the Rufiji landscape, one Community Forest in the Zanzibar landscape, and three National Authority FRs in the Kilwa and Lindi/Rondo landscapes; while the four Very Good scores were for one National Authority FR in the Kilwa landscape and one NR, one Community Forest, and one NP in the Zanzibar landscape. The METT scores from the 2013 study were generally higher than those reported for 24 of the same forests by Burgess et al. (2012), with nine scores changing from Poor in 2012 to Average in 2013, one from Poor to Good, and three from Good to Very Good; only Rupiage FR in the Rufiji landscape decreased significantly in score, from Average to Poor (Table 6.0). Whether the generally positive changes in METT scores between 2012 and 2013 reflect actual improvement in management effectiveness, availability of additional data, or differences in methodology between the studies remains to be

Table 6.0 METT scores for 27 Tanzanian coastal forests in 2013 (WWF Tanzania, unpublished data) and from Burgess et al. (2012)

PA name	Location	Area in km²	Management type	METT 2013	METT 2012
Kitope FR	Kilwa landscape	33.70	National Authority FR	42 (AV)	43 (AV)
Malehi FR	Kilwa landscape	388.50	National Authority FR	45 (AV)	28 (P)
Mangroves FR	Kilwa landscape	367.37	National Authority FR	63 (VG)	57 (G)
Mbinga FR	Kilwa landscape	18.60	National Authority FR	38 (AV)	28 (P)
Mitarure FR	Kilwa landscape	604.80	National Authority FR	36 (AV)	28 (P)
Mitundumbea FR	Kilwa landscape	85.50	National Authority FR	49 (G)	28 (P)
Ngarama North FR	Kilwa landscape	369.60	National Authority FR	35 (AV)	28 (P)
Ngarama South FR	Kilwa landscape	20.70	National Authority FR	37 (AV)	28 (P)
Pindiro FR	Kilwa landscape	117.80	National Authority FR	30 (P)	25 (P)
Rungo FR	Kilwa landscape	225.80	National Authority FR	42 (AV)	28 (P)
Tong'omba FR	Kilwa landscape	19.98	National Authority FR	49 (G)	49 (G)
Jambiani-Muyuni Forest Area	Zanzibar landscape	42.00	Community Forest	48 (G)	
Jozani-Chwaka Bay NP	Zanzibar landscape	50.00	National Park	73 (VG)	
Mtende Community Natural Forest	Zanzibar landscape	4.00	Community Forest	72 (VG)	53 (G)
Ngezi Nature FR	Zanzibar landscape	29.00	Nature Reserve	67 (VG)	53 (G)
Chitoa FR	Lindi/Rondo landscape	7.72	National Authority FR	35 (AV)	31 (AV)
Litipo FR	Lindi/Rondo landscape	9.96	National Authority FR	31 (AV)	35 (AV)
Noto Forest VLFR	Lindi/Rondo landscape	9.90	Local Government FR	22 (P)	
Rondo FR	Lindi/Rondo landscape	120.00	National Authority FR	54 (G)	50 (G)
Katundu FR	Rufiji landscape	56.32	National Authority FR	36 (AV)	41 (AV)
Kichi Hill FR	Rufiji landscape	148.00	Local Authority FR	46 (G)	50 (G)
Kiwengoma FR	Rufiji landscape	35.61	National Authority FR	42 (AV)	34 (AV)
Muhoro FR & Muhoro River	Rufiji landscape	23.98	National Authority FR	42 (AV)	29 (P)
Nyamakutwa-Nyamuete FR	Rufiji landscape	37.48	National Authority FR	43 (AV)	29 (P)
Rupiage FR	Rufiji landscape	40.70	National Authority FR	20 (P)	40 (AV)
Tamburu FR	Rufiji landscape	59.97	National Authority FR	44 (AV)	29 (P)
Utete FR	Rufiji landscape	9.49	National Authority FR	44 (AV)	41 (AV)

EAMCEF (2013) applied the METT to eight NRs and one NP in the EAMs of Tanzania. In ascending order, the METT scores for the nine PAs were: Uzungwa Scarp NR, 52%; Mkingu NR, 53%; Magamba NR, 60%; Uluguru NR, 62%; Nilo NR, 63%; Chome NR, 69%; Kilombero NR, 76%; Amani NR, 79%; Udzungwa Mountains NP, 82%. Thus three of these PAs had METT scores in the range considered Good and the other six were Very Good. All nine PAs were previously FRs; comparison of the 2013 scores with the 2004 and 2009 METT assessments indicates that upgrading of FRs to NRs seems to be a successful conservation and management strategy in the EAMs.

Mpanda et al. (2011) evaluated the impact of changes from private to state tenure on forest resources for three forest blocks in Amani NR, determining resource changes in terms of forest cover, forest stocking, and tree species diversity over a period of six to eight years. Evidence of positive impacts resulting from tenure changes was identified, consistent with the main objective of establishing NRs focusing on biodiversity conservation values.

3.3.3 Actions and research targeting biodiversity

3.3.3.1 Amphibians

Between April 2006 and January 2007, Malonza & Veith (2012) evaluated the relationship of amphibian composition with human habitat disturbance and elevation along 29 transects in the Taita Hills, distributed among terrestrial (forest and plantation) and aquatic (streams and dams) habitats. A total of 23 amphibian species were recorded, including the Endangered Taita African caecilian, *Boulengerula taitana*. Amphibian species richness increased with increased habitat disturbance but decreased with increasing elevation. However, abundance of species that reproduce by direct development, which are restricted to forested habitats, decreased with increased habitat disturbance. In addition to the Taita Hills endemic species *Boulengerula taitana*, two other Taita endemics and direct developers are the Endangered Sagalla caecilian, *Boulengerula niedeni*, which was not found along the transects, and *Callulina dawida*, found in the transects and not assessed on the Red List, but proposed as Critically Endangered by Malonza (2008).

Zancolli et al. (2013) compared the anuran (frog and toad) fauna of Mt. Kilimanjaro with that of the Mt. Meru and the EAMs, concluding that the young geographical age of the northern volcanoes has not provided enough time for most montane frogs to colonize them. Species richness per mountain bloc in the EAMs increased from north to south, with the lowest in North Pare and the highest in Udzungwa and Mahenge. Loader et al. (2014) produced a dated phylogeny of Brevicipitid frogs throughout the Eastern Afromontane Biodiversity Region, including the six threatened species of *Callulina* and the two threatened species of *Probreviceps* on the updated 2013 Outcomes Database. Ancestral-area reconstuctions indicate the presence of Brevicipitids since the Oligocene,

with the central EAMs as the initial center of diversification of the forest species. Due to persistence and stability of forest habitats, the Eastern Arc is an area that has accumulated Brevicipitid frog species over a long span of geological time.

3.3.3.2 Birds

Mwinami et al. (2013) reported the results of a comprehensive avian survey conducted between 2011 and 2013 in Boni and Dodori FRs and the area between them. A total of 185 bird species were recorded, including the Near Threatened Southern banded snake eagle, *Circaetus fasciolatus*, and the Near Threatened Fischer's turaco, *Tauraco fischeri*.

Hassan et al. (2013) assessed the influence of human-induced disturbance on bird communities along permanent transects in four coastal forests in the Pangani-Saadani ecosystem of Tanzania: Kiono/Zaraninge, Kwamsisi/Kwahatibu, Msumbugwe, and Gendagenda. A total of 88 bird species were recorded, including the Endangered Sokoke pipit, *Anthus sokokensis*, the Near Threatened Fischer's turaco, *Tauraco fischeri*, and the Near Threatened Plain-backed sunbird, *Anthreptes reichenowi*. Bird abundance was highest in Msumbugwe, the forest with the highest level of disturbance, while bird species richness and diversity were highest in the least disturbed forests, Kiono/Zaraninge and Kwamsisi/Kwahatibu.

Werema et al. (2013) conducted a preliminary study of the bird species composition of Ikokoto FR in the northeast part of the Udzungwa Mountains using mist netting and general field observations in July 2009. A total of 64 species of birds were reported, including the Near Threatened Moreau's sunbird, *Nectarinia moreaui*. All species belonged to the known assemblage of species present in the larger Udzungwa forests, 61% of the species were forest dependent, and six species were range-restricted forest understory taxa. Therefore despite the small size (ca. 110 ha.) and high degree of fragmentation of this forest, it has significant conservation value for birds and possibly other groups of organisms.

3.3.3.3 Mammals

Mwinami et al. (2013) reported the results of rapid mammal and habitat surveys conducted between 2011 and 2013 in Boni and Dodori FRs and the area between them. Five different habitat types and the main threats to these habitats were identified. A total of 26 mammal species were observed, including the Critically Endangered Aders' duiker, *Cephalophus adersi*, the Vulnerable Pousargues' Sykes' monkey, *Cercopithecus mitis* subsp. *albotorquatus*, the Vulnerable Haggard's oribi, *Ourebia ourebi* subsp. *haggardi*, the Vulnerable African lion, *Panthera leo*, the Vulnerable Common hippopotamus, *Hippopotamus amphibius*, the Near Threatened Coastal topi, *Damaliscus lunatus* subsp. *topi*, the Near Threatened leopard (*Panthera pardus*), and an undescribed species of sengi, *Rhynchocyon* sp.

The East African black-and-white colobus, *Colobus angolensis* subsp. *palliatus*, is discontinuously distributed in the Southern Highlands and coastal forests of southern and eastern Tanzania and in the coastal forests of southeastern Kenya (http://www.iucnredlist.org/details/5142/0). The Kenyan and Tanzanian subpopulations appear to be evolutionarily distinct, and although the subspecies is currently assessed as Least Concern, its status is being reassessed and seems likely to change (BirdLife International, 2013). Wijtten et al. (2012) studied the activity budgets of C. *angolensis* subsp. *palliatus* in a coastal forest patch at Shimoni, Kwale District., Kenya, and compared them with results of activity budget studies of the same subspecies at the more inland East Sagara Forest in Tanzania and of C. *angolensis* subsp. *ruwenzorii* in Rwanda and the Democratic Republic of Congo. General activity level and group size were lower at the Kenyan site, suggesting that the Shimoni subpopulation is adapted to lower activity levels due to scarcity of preferred foods under conditions of poor vegetation quality. Dunham (2013) studied three troops of C. *angolensis* subsp. *palliatus* inhabiting forest patches in Diani Forest characterized by varying levels of degradation and observed significant differences in activity, strata use, and support use but not in positional behavior among the different sites, concluding that morphology plays a greater role than environment in constraining positional behavior.

3.3.3.4 Plants

Dimitrov et al. (2012) used the African violet genus, *Saintpaulia*, as a study system to elucidate factors and processes behind the accumulation of species in tropical montane areas of high biodiversity concentration. This genus is strictly endemic to the EACF, with seven of its eight species and all ten subspecies of *S. ionantha* listed as globally threatened in the June 2014 Red List update, and therefore not included in the statistics for this paper. Results of the study support the hypothesis of climatically stable montane habitats acting as climatic refugia by preventing extinctions in lowland lineages during the Pleistocene. This confers particular importance to the conservation of these montane habitats for the continued survival of regional biodiversity in the face of future impacts of climate change.

3.3.4 Policy development (including site, species, and focused issues)

Researchers working on specific sites and taxonomic groups have formulated policy recommendations based on the results of their studies. For amphibian conservation in the Taita Hills, Malonza & Veith (2012) recommended continued maintenance of a set of forest fragments together with human modified habitats, some form of habitat connectivity, and replacement of exotic plantations with indigenous plants. For primate conservation in the Udzungwa Mountains, Rovero et al. (2012) recommended increased law enforcement measures at Uzungwa Scarp FR, raising community awareness, supporting communities to establish livelihood alternatives to bush meat hunting,

upgrading the FR to a NR (see EAMCEF, 2013), and restoring connectivity between Uzungwa Scarp FR and PAs to the north through the "Mngeta" conservation corridor. KWS (2013) produced an action plan for elephant conservation in Arabuko-Sokoke Forest, with the overall goal to maintain a viable elephant population in Arabuko-Sokoke, enhance the connectivity and quality of habitat and the security of elephants while safeguarding against human-elephant conflict, and increase the value of elephants to people and habitats.

Based on the results of monitoring the status, pressures, and conservation responses in Kenyan IBAs in 2011, Muoria et al. (2013) made the following recommendations, all of which are applicable either generally or in particular to sites within the EACF:

1. Biodiversity must be mainstreamed into all sectors of the economy.
2. The National Government together with agencies such as NEMA should ensure that biodiversity is mainstreamed into County Government Integrated Development Plans, with EIAs conducted for all county developments.
3. Continued research and monitoring of species and habitat conditions are needed in IBAs and for profiling of other potential IBAs and KBAs.
4. Ivory and rhino horn consumers in Asia need to be engaged, informed, and educated.
5. Climate change monitoring needs to be integrated into monitoring protocols.
6. Ways of resolving human-wildlife conflict issues must be sought to reduce the loss of carnivores in Kenya.
7. Kenya Wildlife Service (KWS) needs to act decisively to check ongoing large-scale elephant and rhino poaching.
8. Kenya Forest Service needs to work with stakeholders to ensure that all new policies including charcoal policy are understood by local communities.
9. Continued investment is needed to build the capacity of stakeholders on environmental legislation, devolved governance, and tracking social accountability in order to widen the participation in the review of environmental impacts of developments affecting biodiversity conservation.
10. Action is needed to protect Msidunyi, a private forest adjacent to Vuria Forest in the Taita Hills that hosts at least five pairs of the Critically Endangeered Taita Apalis, *Apalis fuscigularis*.

Danielson et al. (2009) envisaged that locally-based monitoring of natural resources and their use can be effective in management of PAs by local communities. In a study of bush meat hunting in eight villages in the Udzungwa Mountains, Nielsen & Lund (2012) cautioned that locally-based monitoring takes place within the context of competition for access to the benefits of community forest management, and must be independently checked to assure that trends in resource availablility and human disturbance are being accurately reported.

Schaafsma et al. (2012) observed that improved enforcement of conservation policies is expected to increase the costs of charcoal production and other non-timber forest product collection, and therefore reduce extraction levels. Revenue sharing mechanisms will be needed to ensure that losses initially incurred by local communities under stricter enforcement of limits on extraction of both timber and non-timber forest products do not increase poverty levels, but such policies also provide the potential for local communities to benefit from sustainable forest management (Schaafsma et al., 2013).

Nakamura (2013) documented the partitioning of fishery resources on Kilwa Island in southern coastal Tanzania and the differential effect of new policies for conservation and management of coastal resources on different ethnic and economic groups. Bantu fishermen who predominantly fish on the mangrove inland sea have been restricted due to new conservation policies for mangrove environments, while richer Bantu and Arab fishermen who fish on the open sea are little affected by new regulations, causing jealousy and social disruption. Clear understanding of existing local conditions of resource use and management is needed to formulate policy that will be effective in conservation and resource management and improve the livelihoods of local communities.

The Tanzania Forest Service (TFS) was formed in 2010 and is responsible for management of national FRs, bee reserves, and forest and bee resources on general lands. TFS targeted an 80% reduction of illegal activities between 2010 and 2013 (BirdLife International, 2013). As a key part of the strategy to mobilize forest financing in Tanzania, Akida et al. (2012) emphasized the importance of increased stakeholder participation to promote sustainable forest management with clear mechanisms for benefit sharing among stakeholders.

Strategic Environmental Assessment (SEA) refers to a range of approaches to integrate environmental considerations into policies, plans, or programs and evaluate the interlinkages of environmental, economic, and social considerations. The SEA process extends the aims and principles of Environmental Impact Assessment (EIA) beyond the project level, and aims to integrate environmental considerations into higher levels of decision making. The Kenya Environmental (Impact Assessment and Audit) Regulations, 2003 (faolex.fao.org/docs/pdf/ken53040.pdf) directed that lead agencies should subject all public policies, plans, and programs to SEA, but the adoption of SEA in Kenya has been delayed due to inadequate expertise. NEMA (2012) provided an outline of the concept, principles, basic steps, and expected outputs of the SEA process.

The Kenya Wildlife Conservation and Management Act 2013 (Republic of Kenya, 2013) charged the Kenya Wildlife Service (KWS) with a broad range of conservation, management, and enforcement functions. The KWS is responsible for conservation and management of national parks, wildlife conservation areas, and sanctuaries; development of mechanisms for benefit sharing with communities living in wildlife areas;

investigative and enforcement activities for the protection of wildlife; and coordination and conduction of research activities in the field of wildlife conservation and management. Fines and terms of imprisonment are prescribed for offences relating to pollution, licenses and permits, endangered and threatened species, invasive species, sport and trophy hunting, subsistence and bush meat hunting, import and export of wildlife species, and breaches of PA regulations, among others.

The Kenya Forest Policy 2014 (Ministry of Environment, Water and Natural Resources, 2014) supports community forest management approaches as part of an overall strategy for effective forest management.

Several Community Forest Associations (CFAs) have been formed and sensititized on the Kenya Forest Act 2005 and subsidiary legislation such as forest harvesting rules, charcoal rules, and guidelines on community participation in sustainable forest management (BirdLife International, 2013). Following the guidelines of the Kenya Forest Policy 2005, management plans were developed and launched for four coastal forest IBAs: Arabuko-Sokoke Forest, Dzombo Hill Forest, Shimba Hills, and Taita Hills. Musyoki et al. (2013) studied the Ontukigo and Ngare Ndare CFAs in north central Kenya and the difference between CFA and non-CFA members in their participation in forest conservation activities. Although the study area is not within the EACF, its policy recommendations are widely applicable: 1) The Government should encourage the participation of youth and of households with a large number of members and of livestock in the formation of CFAs; 2) The Government should mobilize community members living adjacent to forests to form CFAs for more participation in forest management; 3) The Government should train community members in forest management and other sustainable land use practices; 4) Secure land tenure must be ensured among community members for sustainable participation and support of PFM in new sites.

3.3.5 Number of sites from which benefits accrue to local communities

EAMCEF (2013) conducted a questionnaire survey and interviews of key informants to collect socioeconomic information from communities adjacent to eight NRs and one NP in the EAMs of Tanzania. Information was collected on the livelihoods of households and on the status of alternative sources of forest products to determine the current economic status of the households and allow comparison with their economic status at the end of the project. The overall results showed that the majority of households around all eight NRs were happy with the conservation status of the NRs, while the majority of households (66%) around Udzungwa Mountains NP were not happy with its conservation status due to the restrictions to access to the forest for basic needs and perceived unfairness of rules and regulations governing forest resource use. Most of the communities agreed that they could reduce forest product consumption if alternatives are provided, and alternative sources of forest products were available in most communities, although with variable

degrees of availability and acceptance. Environmental, social, and economic development projects are operating within or around the NP and six of the eight NRs, but their impact on forest conservation and community livelihoods is in need of further assessment.

The Derema Resettlement Action Plan (RAP) was implemented in five villages situated around the Derema Forest Corridor to provide financial compensation and alternative livelihood opportunities for farmers displaced from their farm plots in the area gazetted as Derema FR in 2010 (Muheza District Council, 2013). Hall et al. (2014) demonstrated that while the establishment of the Derema Corridor was successful in enhancement of forest connectivity and improvement of forest condition, the intervention of the RAP failed to mitigate livelihood losses especially among the poorest people.

Shoo & Songorwa (2013) collected data on revenue from eco-tourism in 18 villages surrounding Amani NR and its effect on local livelihoods. Although the Reserve is largely successful in conservation of native biodiversity, economic benefits to the local community were minimal and unevenly distributed, with fewer than one-fourth of households earning any income from eco-tourism, and those largely confined to the villages nearest to the Reserve headquarters.

Matiku et al. (2013) studied the impact of PFM on livelihoods in local communities adjacent to and up to 5 km away from the Arabuko-Sokoke Forest in Kenya. Results showed that forest benefits to the communities exceed costs in PFM zones, but that costs exceed benefits in non-PFM zones, and both costs and benefits reduce with distance from the forest. Thus PFM and associated investment can enhance local communities' livelihoods.

Kareko (2014) reported on a project investigating the linkages between poverty and biodiversity in Kenya's Boni-Dodori forest ecosystem by monitoring the benefits generated by interventions addressing poverty alleviation. Reduction in crop raids by wildlife and building capacity in sustainable agricultural practices can help increase farm yields, enhance food security, provide income from sale of surplus food, and reduce the need to clear more forest areas for agriculture.

Zschauer (2012) studied household energy consumption in the Taita Hills, focusing particularly on the use of firewood. Present methods and circumstances of collecting firewood were compared to the situation 30 years earlier, when legislation put fewer restrictions on the use of forest resources. The availability of firewood in the Taita Hills has diminished and the time and energy required for its collection have increased, with average firewood collection time increasing 35-60% in the last 30 years, placing economic strain on households and underlining the need for new and more sustainable energy souces.

Duvail et al. (2012) evaluated the efficiency and adequacy of the EIA process for a planned large-scale sugar cane plantation in the central floodplain of the Tana River Delta and a planned large-scale *Jatropha curcas* biofuel plantation on the terraces surrounding the delta. The livelihoods of the local communities depend on small-scale farming, fishing, and livestock keeping, all relying on the occurrence of floods in November and May. They concluded that the potential impacts of the projects on water balance and quality and on the environment of the Tana Delta were not adequately addressed in the EIA documents, and that the proposed projects would therefore have highly negative impacts on the livelihoods of the local communities through loss of ecosystem services.

The 2012 status and trends report (BirdLife Internatonal, 2013) provided a comprehensive listing of carbon REDD projects in the EACF, including the Kasigau Corridor REDD project that is just outside the EACF region near the Taita Hills (Atela, 2013). All of these projects are designed to achieve reductions in carbon dioxide emissions from deforestation and degradation and to ensure the livelihoods of local communities by making them beneficiaries of sustainable forest management and REDD financing. Dokken et al. (2014) emphasized that although formalization and securing of land tenure rights are essential in the early phase of REDD+ project implementation, there must also be a strong focus on strengthening village institutions to ensure high levels of compliance and enforcement of forest user rules within project boundaries if implementation is to succeed.

4.0 Conclusions and Recommendations

The importance of the EACF, whether or not it is recognized as a global bioidiversity hotspot in itself, continues to be enhanced by the discovery of new species, expanded and improved knowledge of the geographic and ecological distribution of its globally threatened taxa, new and revised IUCN Red List assessments, biodiversity inventories of currently recognized and potential new IBAs and KBAs, studies of forest health and fragmentation, improvement of environmental quality and natural resource allocation through application of PFM and REDD+ projects, and mainstreaming of biodiversity into policy at local, regional, and national levels. At the same time threats continue to increase as a result of rapidly growing human populations, unsustainable development and resource extraction, environmental damage by invasive species, and uneven and often inadequate management of PAs. Some of the existing gaps in the knowledge needed to address these and other threats can be addressed by:

i. More studies of the capacity of Sustainable Agricultural Intensification (SAI) and Sustainable Land Management (SLM) measures to counteract the environmental degradation caused by unsustainable agroforestry and agricultural practices;
ii. Expanded use of standardized monitoring protocols to assess environmental status and management effectiveness of PAs throughout the EACF;

iii. More and better quantitative estimates of deforestation, especially in Kenyan coastal forests;
iv. Clarification of subspecies status of rare and/or threatened fauna, including: Servaline genet, *Genetta servalina*, in East Usambara; Sykes monkey, *Cercopithecus mitis*, in Boni-Dodori landscape; and Tanzanian and Kenyan subpopulations of East African black-and-white colobus, *Colobus angolensis* subsp. *palliatus*;
v. Intensive plant inventory of botanically uncollected PAs througout the EACF;
vi. More studies on carbon storage and estimates of emission offsets potential;
vii. More studies of extent and intensity of extraction activities of threatened and ecological keystone species and the impact of resource extraction (e.g. charcoal, fuelwood) on environmental health;
viii. Continued and expanded evaluation of the efficiency and adequacy of the EIA process for development projects and integration of EIA into the SEA process at appropriate scale;
ix. More data and analysis of financial compensation for residents displaced from PAs, equitable sharing of revenue from eco-tourism in PAs, impact of PFM on livelihoods of local communities adjacent to PAs, and linkages between poverty and bidiversity in protected and unprotected ecosystems.

The successful reintroduction of the Kihansi spray toad, *Nectophrynoides asperginis*, into its native habitat after being listed as Extinct in the Wild should encourage *ex situ* propagation and reintroduction of other rare and threatened taxa. The Critically Endangered Lake Lutamba coral tree, *Erythrina schliebenii*, now in cultivation at Tanzania State House (Ikulu), is a good candidate for reintroduction, and should serve as a flagship plant species for such efforts.

Sites in the EACF not previously classified as KBAs that may now qualify as such due to the presence of globally threatened taxa are:

1. Lamu District (Kenya) coastal forests (ca. 11 sites)
2. Kilifi Distrct (Kenya) coastal forests (ca. 12 sites)
3. Kwale District (Kenya) coastal forests (ca. 9 sites)
4. Mahenge (Tanzania) (ca. 7 sites)
5. Mtwara District (Tanzania) coastal forests (ca. 5 sites)
6. Tanga District (Tanzania) coast (ca. 5 sites)
7. Masasi District (Tanzania) forests (ca. 6 sites)
8. Mombasa coast (Kenya) (ca. 7 sites)
9. Mahenge (Nambiga FR)
10. Taita District (Kenya) coastal forests (ca. 4 sites)
11. Kaya Timbwa (Kenya)
12. Malundwe (Tanzania)
13. Nachingwea District (Tanzania)

14. Kaya Bura (Kenya)
15. Kisiju Island (Tanzania)
16. Kyngani River (Tanzania)
17. Ruangwa District (Tanzania)

Sites grouped together as e.g. “Lamu District coastal forests” could be listed as KBAs either collectively (as e.g. “Bagamoyo District coastal forests” in Tanzania), or individual sites could be singled out to be listed individually.

Tumbatu Island (Tanzania) should no longer be considered a KBA unless some globally threatened taxon can be found to occur there. Due either to having been merged into other KBAs or for lack of threatened taxa, the following sites should also be deleted from KBA listing: Bungu FR, Lango ya Simba, Mikindani (Mnima), Latham Island, Mtwara, Tanga North-Kibo Salt Pans, and Tanga South.

Policy recommendations formulated by researchers working on specific sites and taxonomic groups should be carefully considered in development of environmental regulations and implementation of management regimes under PFM.

References

Ahrends, A. (2011). Pole, charcoal and timber suitability of tree species in Eastern Tanzania. Version 1.1, compiled for the Valuing the Arc Programme, May 2011. Unpublished.

Akida, A., Mnangwone, I. & Lyimo, L. (2012). Financing for sustainable forest management in Tanzania: country case study. Indufor Oy, Helsinki, Finland.

Atela, J. (2013). Governing REDD+: global framings versus practical evidence from the Kasigau Corridor REDD+ Project, Kenya. STEPS Working Paper 55, STEPS Centre, Brighton, UK.

BirdLife International (2013). Biodiversity status and trends report for the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania Region, 2012. BirdLife International - Africa Partnership Secretariat.

Borghesio, L. (2012). Disturbance in tropical forest ecosystems: perspectives from East Africa. PhD dissertation, University of Illinois at Chicago.

Borghesio, L., Mkongewa, V., Joho, M., Kyonjola, N. & Cordeiro, N. (unpublished). Habitat use of Long-billed tailorbird *Artisornis moreaui* in the East Usambara mountains (Tanzania). [See Appendix 2].

Borghesio, L., Wagura, L., Samba, D. & Githiru, M. (unpublished). Drifting into extinction: results from the long-term monitoring of Taita apalis *Apalis fuscigularis*. [See Appendix 3].

Bullock, R., Mithöfer, D. & Vihemäki, H. (2014). Sustainable agricultural intensification: the role of cardamom agroforestry in the East Usambaras, Tanzania. Int. J. Agric. Sustainability 12: 109-129.

Burgess, N.D., Bahane, B., Clairs, T., Danielson, F., Dalsgaard, S., Funder, M., Hagelberg, N., Harrison, P., Haule, C., Kabalimu, K., Kilahama, F., Kilawe, E., Lewis, S.L., Lovett, J.C., Lyatuu, G., Marshall, A.R., Meshack, C., Miles, L., Milledge, S.A.H., Munishi, P.K.T., Nashanda, E., Shirima, D., Swetnam, R.D., Willcock, S., Williams, A. & Zahabu, E. (2010a). Getting ready for REDD+ in Tanzania: a case study of progress and challenges. Oryx 44: 339-351.

Burgess, N.D., Madoffe, S., Kajembe, G., Trevelyan, R. & Perkin, A. (2010b). Are invasive plant species a problem in the Eastern Arc Mountains? The Arc Journal 25: 23-26.

Burgess, N.D., Harrison, P., Sumbi, P., Laizer, J., Kijazi, A., Salehe, J., Malugu, I., Komba, R., Kinyau, R. & Kashindye, A. (editors). (2012). Towards a sustainably funded protected area network in the coastal forests of Tanzania. Synthesis document of available baseline information on the coastal forests protected area sub-system. WWF-Tanzania, Dar es Salaam.

Butynski, T.M., Douglas-Dufresne, H. & Jong, Y.A. de. (2012). Identification, distribution and conservation status of the African golden cat *Caracal aurata* in Kenya. J. E. African Nat. Hist. 101: 3-16.

Chase, M.W., Thijs, K.W., Kamau, P. & Fay, M.F. (2013). *Dorstenia christenhuszii* (Moraceae), a new species from the Taita Hills, Kenya. Phytotaxa 81: 45-48.

Clarke, G.P., Burgess, N.D., Mbago, F.M., Mligo, C., Mackinder, B. & Gereau, R.E. (2011). Two 'extinct' trees rediscovered near Kilwa, Tanzania. J. E. African Nat. Hist. 100: 133-140.

Clausnitzer, V., Dijkstra, K.-D.B., Koch, R., Boudot, J.-P., Darwall, W.R.T., Kipping, J., Samraoui, B., Samways, M., Simaika, J. & Suhling, F. (2012). Focus on African freshwaters: hotspots of dragonfly diversity and conservation concern. Frontiers Ecol. Environm. 10(3): 129-134.

Cordeiro, N.J. & Seltzer, C.E. (2012). First record of the servaline genet (*Genetta servalina*) in the East Usambara Mountains, Tanzania. J. E. African Nat. Hist. 101: 17-27.

Critical Ecosystem Partnership Fund (2003). Ecosystem Profile: Eastern Arc Mountains & Coastal Forests of Tanzania & Kenya Biodiversity Hotspot. Conservation International, Washington, DC.

Danielson, F., Burgess, N.D., Balmford, A., Donald, P.F., Funder, M., Jones, J.P.G. & Alviola, P. (2009). Local participation in natural resource monitoring: a characterization of approaches. Conservation Biol. 23: 31-42.

Dimitrov, D., Nogués-Bravo, D. & Scharff, N. (2012). Why do tropical mountains support exceptionally high biodiversity? The Eastern Arc Mountains and the drivers of *Saintpaulia* diversity. PLoS ONE 7(11): e48908. doi:10.1371/journal.pone.0048908

Doggart, N. (2014). MJUMITA Community Forest Project: Lindi. First Project Implementation Report. http://www.tfcg.org/makingReddWork.html

Dokken, T., Caplow, S., Angelsen, A. & Sunderlin, W.D. (2014). Tenure issues in REDD+ pilot project sites in Tanzania. Forests 2014, 5, 234-255. doi: 10.3390/f5020234

Dunham, N.T. (2013). Positional behavior and habitat use of Peters' Angola black and white colobus monkey (*Colobus angolensis palliatus*) in structurally distinct areas of the Diani Forest, Kenya. MSc thesis, The Ohio State University.

Duvail, S., Médard, C., Hamerlynck, O. & Nyingi, D.W. (2012). Land and water grabbing in an East African coastal wetland: the case of the Tana Delta. Water Alternatives 5: 322-343.

EAMCEF (2013). Baseline survey report for 8 Nature Reserves and 1 National Park in the Eastern Arc Mountains of Tanzania. Eastern Arc Mountains Conservation Endowment Fund, Morogoro, Tanzania.

Gereau, R.E., Luke, W.R.Q., Kindeketa, W., Bodine, S. & Schatz, G.E. (2009). Plant conservation assessment in East Africa: procedures and first results. Pp. 469-473 *in*: van der Burgt, X., van der Maesen, J. & Onana, J.-M. (editors), Systematics and Conservation of African Plants. Proceedings of the 18th AETFAT Congress, Yaoundé, Cameroon. Royal Botanic Gardens, Kew.

Gereau, R.E. & Kindeketa, W.J. (2014). Botanical inventory of the protected area network in Tanzania: a preliminary gap analysis. Unpublished report: Tanzania Forestry Research Institute.

Godoy, F.L., Tabor, K., Burgess, N.D., Mbilinyi, B.P., Kashaigili, J.J. & Steininger, M.K. (2011). Deforestation and CO2 emissions in coastal Tanzania from 1990 to 2007. Environm. Conservation 39: 62-71.

Green, J.M.H., Larrosa, C., Burgess, N.D., Balmord, A, Johnston, A., Mbilinyi, B.P., Platts, P.J. & Coad, L. (2013). Deforestation in an African biodiversity hotspot: Extent, variation and the effectiveness of protected areas. Biol. Conservation 164: 62-72.

Hall, J.M., Gillespie, T.W. & Mwangoka, M. (2011). Comparison of agroforests and protected forests in the East Usambara Mountains, Tanzania. Environm. Managem. 48: 237-247.

Hall, J.M., Burgess, N.D., Rantala, S, Vihemäki, H., Jambiya, G., Gereau, R.E., Makonda, F., Njilima, F., Sumbi, P. & Kijazi, A. (2014). Ecological and social outcomes of a new protected area in Tanzania. Conservation Biol. DOI: 10.1111/cobi.12335

Hassan, S.N., Salum, A.R., Rija, A.A., Modest, R., Kideghesho, J.R. & Malata, P.F. (2013). Human-induced disturbances influence on bird communities of coastal forests in eastern Tanzania. Brit. J. Appl. Sci. & Technol. 3: 48-64.

Hockings, M., Stolton, S., Leverington, F., Dudley, N. & Courrau, J. (2006.) Evaluating effectiveness: a framework for assessing management effectiveness of protected areas (2nd edition). IUCN, Gland, Switzerland and Cambridge, UK.

Itkonen, P. (2012). Estimating leaf area index and aboveground biomass by empirical modeling using spot HRVIR satellite imagery in the Taita Hills, SE Kenya. MSc thesis, University of Helsinki.

Jenkins, R.K.B., Maliti, H.T. & Corti, G.R. (2003). Conservation of the puku antelope (*Kobus vardoni*, Livingstone) in the Kilombero Valley, Tanzania. Biodiversity & Conservation 12: 787-797.

Jones, T., Bamford, A.J., Ferrol-Schulte, D, Hieronimo, P., McWilliam, N. & Rovero, F. (2012). Vanishing wildlife corridors and options for restoration: a case study from Tanzania. Trop. Conservation Sci. 5: 463-474.

Jones, T. & Bowkett, A.E. (2012). New populations of an endangered Tanzanian antelope confirmed using DNA and camera traps. Oryx 46: 14-15.

Jong, M. de (2013). Modelling of soil erosion and sustainable land management measures in the Usambara Mountains, Tanzania. MSc thesis, Universiteit Utrecht.

Kacholi, D.S. (2014). Analysis of structure and diversity of the Kilengwe Forest in the Morogoro Region, Tanzania. Int. J. Biodiversity Volume 2014, Article ID 516840 http://dx.doi.org/10.1155/2014/516840

Kareko, K. (2014). Community-based conservation and livelihoods development within Kenya's Boni-Dodori forest ecosystem. Darwin Initiative June 2014 Newsletter, p. 15. www.darwininitiative.org.uk/assets/uploads/2014/05/Darwin-Initiativ e-Newsletter-June-2014-Final.pdf

Kashaigili, J.J., Mdemu, M.V., Nduganda, A.R. & Mbilinyi, B.P. (2013). Integrated assessment of forest cover change and above-ground carbon stock in Pugu and Kazimzumbwi Forest Reserves, Tanzania. Advances in Remote Sensing 2013(2): 1-9.

Kenya Forest Service (2013). Analysis of drivers and underlying causes of forest cover change in the various forest types of Kenya. Ministry of Forestry and Wildlife, Nairobi.

Kimuyu, D.M., Wahungu, G.M. & Otieno, D.O. (2012). Seed dispersal by Tana River mangabeys in fragmented gallery forests. Open J. Ecol. 2: 12-20.

KWS (2013). Arabuko-Sokoke forest elephants conservation action plan, (2013-2023).

Kenya Wildlife Service, Nairobi, Kenya.

Leonard, C., Mwangoka, M., Mkongewa, V., Doggart, N. & Vihemäki, H. (2010). Assessment of the biological values of different land cover types in the East Usambara Mountains of Tanzania. TFCG Technical Paper No. 23, Dar es Salaam.

Loader, S.P., Poynton, J.C., Lawson, L.P., Blackburn, D.C. & Menegon, M. (2011). Herpetofauna of montane areas of Tanzania. 3. Amphibian diversity in the northwestern Eastern Arc Mountains, with the description of a new species of *Arthroleptis* (Anura: Arthroleptidae). Fieldiana, Life & Earth Sci. 4: 90-102.

Loader, S.P., Ceccarelli, F.S., Menegon, M., Howell, K.M., Kassahun, R., Abebe A. Mengistu, Saber, S.A., Fikirte Gebresenbet, Sá, R. de, Davenport, T.R.B., Larson, J.G., Müller, H., Wilkinson, M. & Gower, D.J. (2014). Persistence and stability of Eastern Afromontane forests: evidence from brevicipitid frogs. J. Biogeogr. http://wileyonlinelibrary.com/journal/jbi doi:10.1111/jbi.12331

Luke, Q., Bangirinama, F., Beentje, H., Bujo, F., Gereau, R., Kalema, J., Ensermu Kelbessa, Maunder, M., Minani, V., Kindeketa, W., Mwangoka, M., Ndangalasi, H., Kabuye, C., Kamau, P., Malombe, I., Mbaluka, K., Mwachala, G., Manoko, M. & Nyange, M. (2014). Progress in assessing the conservation status of Eastern African Plants. *In*: Bytebier, B., Muasya, A.M. & Bellstedt, D.U. (editors), XXth AETFAT Congress - South Africa, 13-17 January 2014. Abstracts. Scripta Bot. Belg. 52: 248.

Malonza, P.K. (2008). Amphibian biodiversity in Taita Hills, Kenya. PhD dissertation, Univ. of Mainz, Germany.

Malonza, P.K. & Veith, M. (2012). Amphibian community along elevational and habitat disturbance gradients in the Taita Hills, Kenya. Herpetotropicos 7 (1-2): 7-16.

Matiku, P., Caleb, M. & Callistus, O. (2013). The impact of participatory forest management on local community livelihoods in the Arabuko-Sokoke Forest, Kenya. Conservation & Soc. 11: 112-129.

Mattee, A.Z., Mahonge, C.P.I., Nsenga, J.V. & Kayeye, H. (2013). Linking livelihood improvement and environmental conservation: case of East Uluguru Mountains in Tanzania. Int. J. Environm. Sci., Managem. & Engin. Res. 2: 106-116.

Ministry of Environment, Water and Natural Resources. (2014). Forest Policy, 2014. Republic of Kenya.
http://www.kenyaforestservice.org/documents/Forest%20Policy,%202014%20(Revised%2020-2-2014).pdf

Mittermeier, R.A., Robles G., R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Da Fonseca, G.A.B. (2004). Hotspots Revisited. CEMEX.

Miya, M., Ball, S.M.J. & Nelson, F.D. (2012). Drivers of deforestation and forest degradation in Kilwa District. Unpublished report: Mpingo Conservation & Development Initiative.

Mngumi, L., Shemdoe, R.S. & Liwenga, E. (2013). Community perceptions and willingness to accept and execute REDD+ initiative: the case of Pugu and Kazimzumbwi Forest Reserves, Tanzania. Cross-Cult. Commun. 9(3): 48-54.

Mpanda, M.M., Luoga, E.J., Kajembe, G.C. & Eid, T. (2011). Impact of forestland tenure changes on forest cover, stocking and tree species diversity in Amani Nature Reserve, Tanzania. Forests, Trees & Livelihoods 20: 215-230.

Muheza District Council (2013). The brief report on resettlement action plan, conservation and management of Derema Forest Reserve, in the East Usambara Mountains. Natural Resources Office, Muheza, Tanzania.

Muoria, P., Barasa, F., Mwinami, T., Kanga, E., Mwang'ombe, J., Ithagu, B., Mulwa, R., Matiku, P. & Ng'weno, F. (2013). Kenya's Important Bird Areas: status and trends 2011. Nature Kenya, Nairobi.

Musyoki, J.K., Mugwe, J., Mutundu, K. & Muchiri, M. (2013). Determinants of household decision to join community forest associations: a case study of Kenya. ISRN Forestry Volume 2013, Article ID 902325 http://dx.doi.org/10.1155/2013/902325

Mwinami, T., Ochieng, O.T., Ngala, M., Sandy, O., Musila, S., Kimwele, C. & Ng'weno, F. (2013). Avifauna survey in Boni-Dodori National Reserves, adjacent forests and community land, north coast - Kenya. Conservation Leadership Programme, Nairobi.

Nakamura, R. (2013). Coastal resource use and management on Kilwa Island, southern Swahili Coast, Tanzania. AWERProcedia Advances Appl. Sci. [Online] 1: 364-370. http://www.world-education-center.org/index.php/paas/article/view/2265

Nature Kenya (2008). Conservation for sustainable living. Investing in capacity building, nature-based enterprises and business support to conserve the Dakatcha Woodland by and for local communities. Unpublished document, Nature Kenya, Nairobi.

Ndang'ang'a, P.K., Eshiamwata, G., Ngari, A., Pius, E., John, J., Arinaitwe, J. & Mbwana, S. (2008). Status report for the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania Region, 2008. BirdLife International - Africa Partnership Secretariat.

Ndang'ang'a, P.K., Muoria, P., Barasa, F.M. & Kariuki, M.N. (submitted). Trends in condition, threats and conservation action at key biodiversity forest sites in coastal Kenya. African J. Ecol.

NEMA (2012). National guidelines for strategic environmental assessment (SEA) in Kenya. National Environment Management Authority, Nairobi.

Ng'weno, F. (2013). Clarke's Weavers confirmed breeding in Dakatcha woodland! Nature Net May 2013: 1-2.

Nielsen, M.R. & Lund, J.F. (2012). Seeing white elephants? The production and communication of information in a locally-based monitoring system in Tanzania. Conservation & Soc. 10: 1-14.

Nielsen, M.R., Jacobsen, J.B. & Thorsen, B.J. (2014). Factors determining the choice of hunting and trading bushmeat in the Kilombero Valley, Tanzania. Conservation Biol. 28: 382-391.

Ocholla, G.O., Bunyasi, M.M., Asoka, G.W., Pacha, O., Mbugua, H.K., Mbuthi, P., Mbiti, S., Wendo, H.K. & Kamau, P.K. (2013). Environmental issues and socio-economic problems emanating from salt mining in Kenya; a case study of Magarini District. Int. J. Humanit. & Social Sci. 3: 213-223.

Ojoyi, M. & Delay, L.S. (2014). Modelling change patterns in Nguru forest in the Eastern Arc Mountains, Tanzania. Unpublished report: ICIPE, Nairobi & Natural Resource Institute, New Mexico, USA.

Omoro, L.M.A., Starr, M. & Pellika, P.K.E. (2013). Tree biomass and soil carbon stocks in indigenous forests in comparison to plantations of exotic species in the Taita Hills of Kenya. Silva Fenn. 47(2) article id 935 (www.silvafennica.fi/article/935)

Pellikka, P.K.E., Lötjönen, M., Siljander, M. & Lens, L. (2009). Airborne remote sensing of spatiotemporal change (1955–2004) in indigenous and exotic forest cover in the Taita Hills, Kenya. Int. J. Appl. Earth Observ. Geoinform. 11: 221–232.

Preston, M.A. (2011). Anthropogenic disturbance of forests, its effects on primates, and conservation in West Usambara, Tanzania. PhD dissertation, University of California, Davis.

Republic of Kenya (2013). The Wildlife Conservation and Management Act, 2013. Kenya Gaz. Suppl. 181 (Acts No. 47): 1235-1350.

Rocky, J. & Mligo, C. (2012). Regeneration pattern and size-class distribution of

indigenous woody species in exotic plantation in Pugu Forest Reserve, Tanzania. Int. J. Biodiversity & Conservation 4: 1-14.

Rovero, F., Mtui, A.S., Kitegile, A.S. & Nielsen, M.R. (2012). Hunting or habitat degradation? Decline of primate populations in Udzungwa Mountains, Tanzania: an analysis of threats. Biol. Conservation 146: 89-96.

Ruuska, E. (2013). Unsustainable charcoal production as a contributing factor to woodland fragmentation in southeast Kenya. Fennia 191: 58-75.

Schaafsma, M., Morse-Jones, S., Posen, P., Swetnam, R.D., Balmford, A., Bateman, I.J., Burgess, N.D., Chamshama, S.A.O., Fisher, B., Green, R.E., Hepelwa, A.S., Hernández-Sirvent, A., Kajembe, G.C., Kulindwa, K., Lund, J.F., Mbwambo, L., Meilby, H., Ngaga, Y.M., Theilade, I., Treue, T., Vyamana, V.G. & Turner, R.K. (2012). Towards transferable functions for extraction of Non-timber Forest Products: a case study on charcoal production in Tanzania. Ecol. Econ. 80: 48-62.

Schaafsma, M., Burgess, N.D., Swetnam, R., Ngaga, Y., Ngowi, S., Turner, K. & Treue, T. (2013). Tanzanian timber markets provide early warnings of logging down the timber chain. 15th Annual BIOECON Conference, Conservation and Development: Exploring Conflicts and Challenges, 18-20 September 2013, Kings College, Cambridge. http://www.bioecon-network.org/pages/15th_2013/SCHAAFSMA.pdf

Seki, H.A., Bowkett, A.E., Bungard, M.J., Doggart, N. & Menegon, M. (2011). Current status of three endangered hyper-endemic amphibian species in the Uzungwa Scarp Forest Reserve, Tanzania. Tanzania Forest Conservation Group and Whitley Wildlife Conservation Trust, Dar es Salaam, Tanzania.

Shirk, P. & Vonesh, J. (2013). Effects of habitat loss and fragmentation on Eastern Arc Mountain forest chameleons. Biodiversity Sci. 9, http://www.biodiversityscience.com/2013/04/10/eastern-arc-mountain-forest-chameleons/

Shoo, R.A. & Songorwa, A.N. (2013). Contribution of eco-tourism to nature conservation and improvement of livelihoods around Amani Nature Reserve, Tanzania. J. Ecotourism 12: 75-89, http://dx.doi.org/10.1080/14724049.2013.818679.

Siex, K. (2011). Protected area spatial planning for Unguja and Pemba Islands, Zanzibar. A consultancy to the UNDP-GEF-Extending the Coastal Forest Area Protected Area Subsystem in Tanzania. World Wide Fund for Nature (WWF). TFCG Technical Paper No. 23: 1-91.

Werema, C., McEntee, J.P., Mulungu, E. & Mbilinyi, M. (2013). Preliminary observations

on the avifauna of Ikokoto Forest, Udzungwa Mountains, Tanzania. Scopus 32: 19-26.

Wijtten, Z., Hankinson, E., Pellissier, T., Nuttall, M., & Lemarkat, R. (2012). Activity budgets of Peters' Angola black-and-white colobus (*Colobus angolensis palliatus*) in an East African coastal forest. African Primates 7: 203-210.

Willcock, S., Phillips, O.L., Platts, P.J., Balmford, A., Burgess, N.D., Lovett, J.C., Ahrends, A., Bayliss, J., Doggart, N., Doody, K., Fanning, E., Green, J., Hall, J., Howell, K.L., Marchant, R., Marshall, A.R., Mbilinyi, B., Munishi, P.K.T., Owen, N., Swetnam, R.D., Topp-Jørgensen, E.J. & Lewis, S.L. (2012). Towards regional, error-bounded landscape carbon storage estimates for data-deficient areas of the world. PLoS ONE 7(9): e44795. doi:10.1371/journal.pone.0044795

Zancolli, G., Steffan-Dewenter, I. & Rödel, M.-O. (2013). Amphibian diversity on the roof of Africa: unveiling the effects of habitat degradation, altitude and biogeography. Diversity Distrib. 20: 297-308.

Zschauer, K. (2012). Households' energy supply and the use of fuelwood in the Taita Hills, Kenya. Msc thesis, Univ. of Helsinki.

Appendix 1: List of a collapsed set of monitoring indicators and tools for aggregating information at the regional level as agreed by stakeholders in the EACF

INDICATOR	LEVEL	TOOL/METHOD
Change in status of threatened species or infraspecific taxa	Species, subspecies, variety	Assessment of rate at which number of taxa in each IUCN Red List threatened category and total number of threatened taxa changes (Red List index)
Change in habitat extent in Key Biodiversity Areas (KBAs)	Landscape	Analyzing satellite data and ground truthing reports to track habitate change in KBAs over time
Change in fragmentation in protected areas and biodiversity conservation corridors	Landscape	Analyzing satellite data and ground truthing reports to track changes in proportion of habitat far (>1 km) from non-habitat edge, and proportion of habitat not in small (<100 km^2) isolated patches
PRESSURE INDICATORS		
Change in extraction intensity of globally threatened taxa for commercial use and damage to threatened taxa caused by extraction of other species or resources	Species, subspecies, variety	Data derived from TRAFFIC database, disturbance transects, research papers and reports
Change in human population density in adminstrative units contained in the Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania	Landscape	Review of National Bureau of Statistics reports in Kenya and Tanzania

RESPONSE INDICATORS		
Change in protection status of Key Biodiversity Areas (KBAs)	Site/Landscape	Tracking the change in percentage of KBAs with official protection status using e.g. the World Database on Protected Areas (WDPA) and requesting information elsewhere
Change in management effectiveness of protected areas/KBAs	Site/Landscape	The World Commission on Protected Areas (WCPA) Management Effectiveness Tracking Tool (METT). METT will be used to assess the percent of sites being managed effectively and the mean percent change in scores across sites between assessments.
Change in number of threatened taxa with research and monitoring in place	Species, subspecies, variety	Assessment of species-related data collected using a species data request form and exhaustive literature review
Change in number and percentage of globally threatened taxa that have national protection status	Species, subspecies, variety	Review of relevant acts, policies, legal notices in Kenya and Tanzania

Appendix 2

Habitat use of Long-billed Tailorbird *Artisornis moreaui* in the East Usambara mountains (Tanzania)

Luca Borghesio, Victor Mkongewa, Martin Joho, Nsajigwa Kyonjola and Norbert Cordeiro

Actions to preserve East African globally-threatened birds are hindered by a lack of detailed ecological knowledge on these species. Since 2006, we have been studying the ecology of the Long-billed tailorbird (*Artisornis moreaui*), a Critically Endangered, secretive forest dweller. This bird is endemic to a range of less than 1000 km^2, split between two widely separated areas, the East Usambara mountains in Tanzania and Serra Jeci in northern Mozambique. The Long-billed tailorbird inhabits forest glades and edges, where it forages in dense tangles of vines or bushy vegetation (McEntee et al., 2005). However, there is a need to obtain more quantitative information, especially on the effect that different habitat features have on the tailorbird presence and abundance. This is especially important because habitat destruction through mining for gold and illegal tree harvesting may have a negative impact on this species population.

We carried out our observations on a network of 530 sample points located at 200m-intervals along transects covering the entire area above 700m elevation (the lowest elevation limit of the species) in the East Usambaras (Fig 1). Sample points were visited multiple (2 to 27) times, using recorded vocalizations of the species to elicit its vocal response. We obtained 320 records of Long-billed tailorbird (Fig 1), representing >80 territories, fifteen of which have been occupied for extended periods of time (5 to 7 years).

Results show that the Long-billed tailorbird avoids forest fragments: all the records were obtained inside continuous forest or in bushy vegetation growing along the edges of continuous forest (Fig 1). Inside the forest, territories are located in relatively open sites, such as stream lines and gaps. As a result, canopy in occupied territories is significantly more open than randomly selected forest sites. Thirty-five percent of the records were obtained within 100m of forest edges. This is less than the number expected based on the proportion of sample points located along forest edges (Fig 2), suggesting negative factors are affecting Long-billed tailorbird in forest edges.

The abundance of Long-billed tailorbird is also significantly depressed in sites invaded by *Maesopsis eminii*, an exotic tree that was introduced to the East Usambaras for forestry purposes. This pattern is observed both along forest edges and in forest interior and both in the southern (Amani) and in the northern sections (Nilo and Derema) of the Eastern Usambara (Table 1).

Our data suggest that the presence of Long-billed tailorbird is significantly reduced in disturbed forest, which is heavily invaded by *Maesopsis eminii*. Moreover, the lower recording frequency of the species along edges might be linked to a higher degree of *Maesopsis* invasion, because, as table 1 shows, recording frequencies are similar in uninvaded forest edges and forest interior. In turn, reduced abundance of Long-billed tailorbird in *Maesopsis*-invaded sites might be due to scarcely developed understorey vegetation, and to the lack of the dense bushy tangles, which the tailorbird requires for foraging and nesting.

As direct removal of *Maesopsis* is problematic due to its fast regeneration rate, we are currently investigating alternative techniques to improve vegetation quality along forest edges. We are carrying out a controlled experiment where human disturbance (removal of bushy vegetation) is minimized inside experimental plots located at six sites along forest edges. We hypothesize that, as bushy vegetation grows and increases in density, that the tailorbird will likely colonize the experimental plots. Results of this experiment will eventually lead to large-scale conservation initiatives to improve vegetation quality along forest edges in the East Usambara Mts.

Citation McEntee, J., Cordeiro, N.J., Joho, M.P., Moyer, D.C., 2005. Foraging observations of the threatened Long-billed Tailorbird Artisornis moreaui in Tanzania. Scopus 25, 51–54.

Table 1. Recording frequency (sample size in parentheses) of Long-billed tailorbird (*Artisornis moreaui*) in sample points with different degree of invasion by the exotic tree *Maesopsis eminii*. Recording frequencies drop significantly when *Maesopsis* invasion exceeds 20%.

Zone	Location	*Maesopsis*			
		0-20%	21-40%	41-60%	>60%
Amani	Edges	0.09 (218)	0.03 (481)	0.03 (441)	0.02 (515)
	Forest interior	0.09 (1663)	0.03 (666)	0.01 (535)	0.00 (463)
Nilo and Derema	Edges	0.14 (29)	0.00 (10)	0.00 (12)	0.00 (12)
	Forest interior	0.10 (260)	0.03 (64)	0.00 (30)	0.00 (30)

Figure 1. Map of the study area in the East Usambara. Indigenous forest is represented in green colour. Black lines are 400-800 and 1200m contours respectively. Red dots are the 530 sample points, blue dots represent records of Long-billed Tailorbird

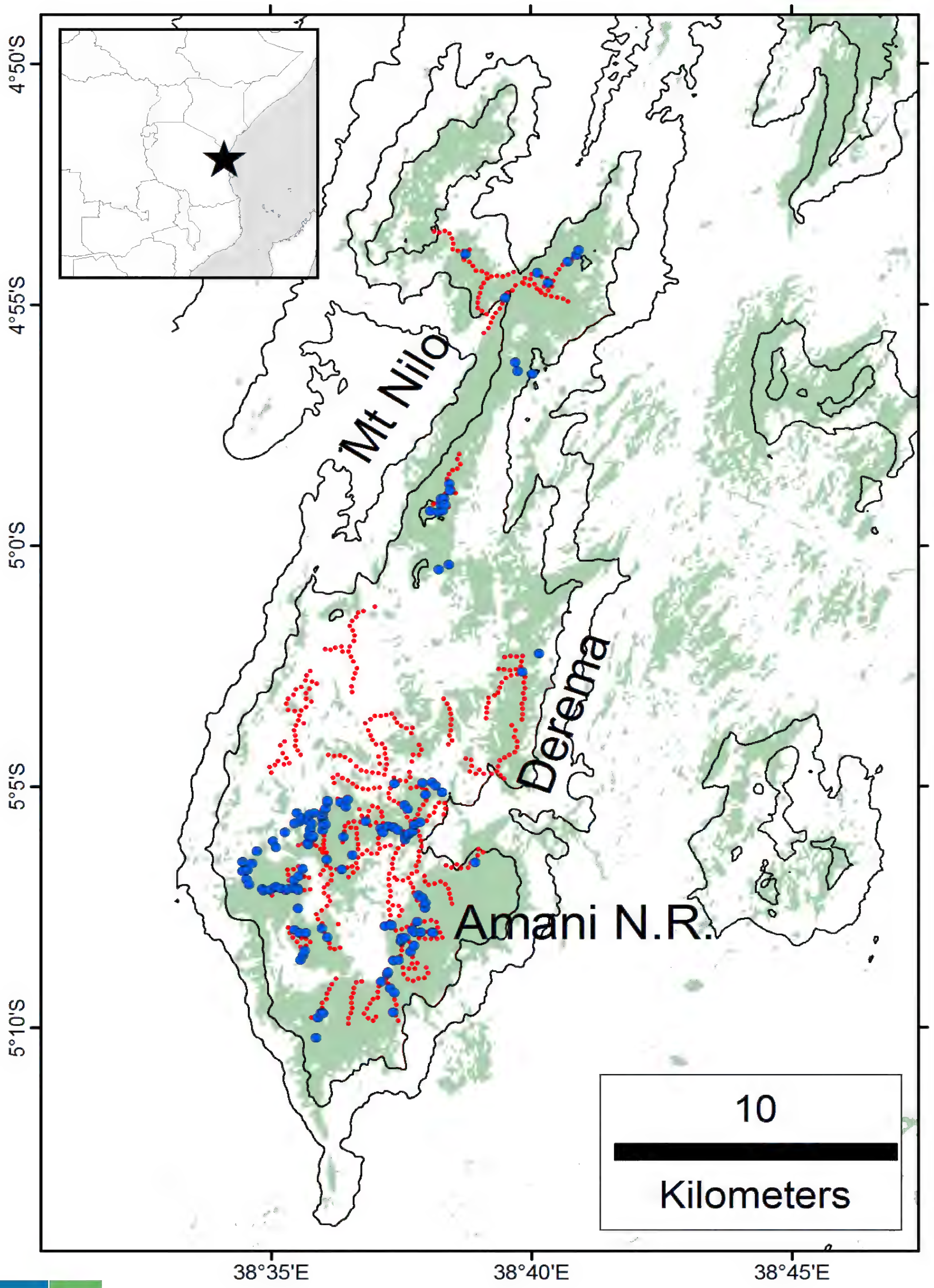
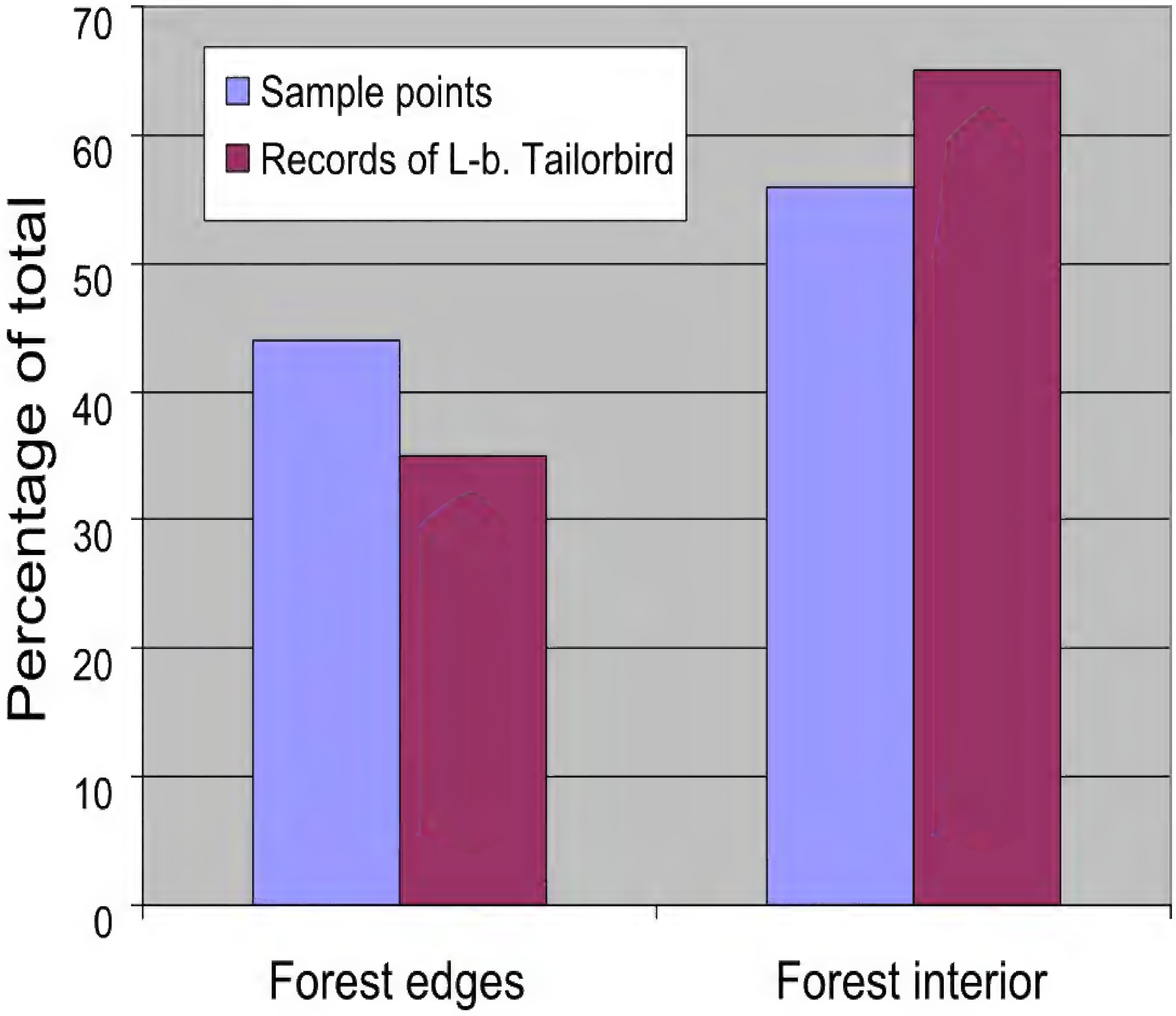


Figure 2. Percentage of the total number of records of Long-billed tailorbird (*Artisornis moreaui*; n = 320) and of sample points (n = 530) located near forest edges or in forest interior. Records of Long-billed tailorbird are significantly less than expected along forest edges (chi-square test, $p < 0.01$)



Appendix 3

Drifting into extinction: results from the long-term monitoring of Taita apalis *Apalis fuscigularis*

Luca Borghesio, Lawrence Wagura, Daina Samba and Mwangi Githiru

Apalis fuscigularis is a Critically Endangered bird endemic to a tiny range (less than 500ha) in the Taita hills of Southern Kenya, where indigenous forest deforestation has been estimated to >95% globally, and 50% in the last 60 years (Newmark, 1998; Pellikka et al. 2009). *A. fuscigularis* is restricted to montane forest at 1,500–2,200m, and inhabits the forest understorey, favouring gaps and edges with dense undergrowth, where it gleans insects from vegetation mainly 0–2 m above ground (BirdLife International, 2012). Surveys carried out in 2001, estimated a population of 310-654 individuals, 65% of which located in a single forest fragment (Ngangao), while two other fragments (Vuria and Chawia) hosted smaller subpopulations (Borghesio et al., 2010).

Since 2001, *A. fuscigularis'* range and abundance have been monitored using standardised counting techniques and opportunistic playback surveys in all currently known indigenous forest fragments of the Taita Hills. The standardised counts have been performed on a grid of c.900 regularly spaced sample points (100m distance). The grid covers all the seven forest fragments where the species has been recorded so far (Fig. 1). At each sample point, data were collected with 10-min point counts without playback of *Apalis* vocalizations, all the observations of *A. fuscigularis* within a radius of 60m were recorded.

Playback surveys performed between 2009 and 2014 have slightly expanded the known range of *A. fuscigularis*. Previously unreported subpopulations were observed in Msidunyi, Yale and Mbololo, while old records (Brooks et al., 1998) have been reconfirmed in Fururu (Table 1). However, the effect of these discoveries on the total population are minor, either due to the small size of these forest fragments, or to the low population density of *A. fuscigularis* there (Table 1). In Yale (3.3ha) only one pair has been observed in several visits. In Fururu (8.0ha) a pair was observed once in October 2010, but successive visits did not produce further observations. In Mbololo (178ha) one-two pairs might represent a small nucleus surviving in an impervious area near the forest edge. The small Msidunyi fragment (7.1ha), discovered in 2011, hosts an estimated 8 pairs. All in all, less than 15 pairs appear to exist in these range extensions.
Repeated monitoring of the three main strongholds (Ngangao, Vuria and Chawia) of the species provides evidence of widespread and steady decrement in range and numbers. Contact rates in the standardized point counts have markedly decreased in all three fragments (Table 1). In Chawia, in March 2014, one day of searches with playback of recorded songs failed to produce any records of the species, suggesting that *A. fuscigularis* might now be nearing local extinction in this forest. In Ngangao, contact rates have decreased by >60% since 2001, while decrements are more contained in Vuria

(Table 1). Paralleling the decrement of recording frequencies, a marked range contraction is also apparent in Ngangao forest (Fig 2).

In summary, evidence obtained in the field strongly supports the hypothesis of a dramatic decrement of *A. fuscigularis* over the last 15 years. The causes of this negative trend are unknown, but are likely to be multifactorial. Direct destruction of habitat by human activities has been observed on several occasions along forest edges in Ngangao, Vuria and Msidunyi. Nest predation is intense in the Taita forest (Spanhove et al., 2009) and might also be involved. The effects of climate change and of key habitat/food resources deserve to be studied in detail, but no information is available on these potential causes of decrement at the moment. Exotic tree plantations are largely avoided by *A. fuscigularis*, and their expansion in the area over the last decades (Pellikka et al., 2009) is another reason for concern. At the same time, plantations might be a target for conservation interventions. The removal of exotic trees could contribute to restoring habitat for the species, especially of early successional habitats, which appear to be the preferred nesting habitat of *A. fuscigularis (Wagura et al., 2012)*.

References

BirdLife International, 2012. Species factsheet: *Apalis fuscigularis* [WWW Document]. URL www.birdlife.org/datazone (accessed 4.22.12).

Borghesio, L., Samba, D., Githiru, M., Bennun, L., Norris, K.E.N., 2010. Population estimates and habitat use by the Critically Endangered Taita Apalis *Apalis fuscigularis* in south-eastern Kenya. Bird Conserv. Int. 20, 440–455. doi:10.1017/S0959270910000298.

Brooks, T., Lens, L., Barnes, J., Barnes, R., Kihuria, J.K., Wilder, C., 1998. The conservation status of the forest birds of the Taita Hills, Kenya. Bird Conserv. Int. 8, 119–139. doi:10.1017/S0959270900003221

Newmark, W.D., 1998. Forest Area, Fragmentation, and Loss in the Eastern Arc Mountains: Implications For the Conservation of Biological Diversity. J. East Afr. Nat. Hist. 87, 29–36. doi:10.2982/0012-8317(1998)87

Pellikka, P.K.E., Lötjönen, M., Siljander, M., Lens, L., 2009. Airborne remote sensing of spatiotemporal change (1955–2004) in indigenous and exotic forest cover in the Taita Hills, Kenya. Int. J. Appl. Earth Obs. Geoinformation 11, 221–232.

Spanhove, T., Lehouck, V., Lens, L., 2009. Inverse edge effect on nest predation in a Kenyan forest fragment: an experimental case study. Bird Conserv. Int. 19, 367–378.

Wagura, L., Githiru, M., Borghesio, L., 2012. Notes on the nesting biology of Taita Apalis

Apalis fuscigularis. Bull. Afr. Bird Club 12, 42–46.

Table 1. Recording frequencies (no. of individuals per 100 sample points) of *Apalis fuscigularis* in standardised point counts 2001-2014. "P" indicates fragments where the presence of the species was confirmed, but no standardised counts were done at that time. "?" Indicates unsuccessful searches performed with playback in that forest fragment.

Dates	Chawia	Fururu	Mbololo	Msidunyi	Ngangao	Vuria	Yale
Feb-May 2001	6				43	37	
Jun-Sep 2001	8				36	33	
Apr-Jun 2009	2		1		36	13	9
Sep-Dec 2009	2		0		9	14	0
May-Jul 2010	3		0		8	13	0
Nov-Dec 2010			1		11		0
Jan 2011	0			P		18	
Oct-Dec 2011	0	P		8	9	28	0
Nov-Dec 2012	1	?	0	P		P	P
Jan-Feb 2013				P	12	12	P
Mar 2014	?	?		P	P	P	P
All years	2	0	2	8	16	20	31

Figure 1. Map of the Taita hills, Kenya, showing the seven forest fragments where *Apalis fuscigularis* has been recorded between 2001 and 2014. The blue line marks the 1500m contour, which is the lowest elevation at which *A. fuscigularis* has ever been recorded

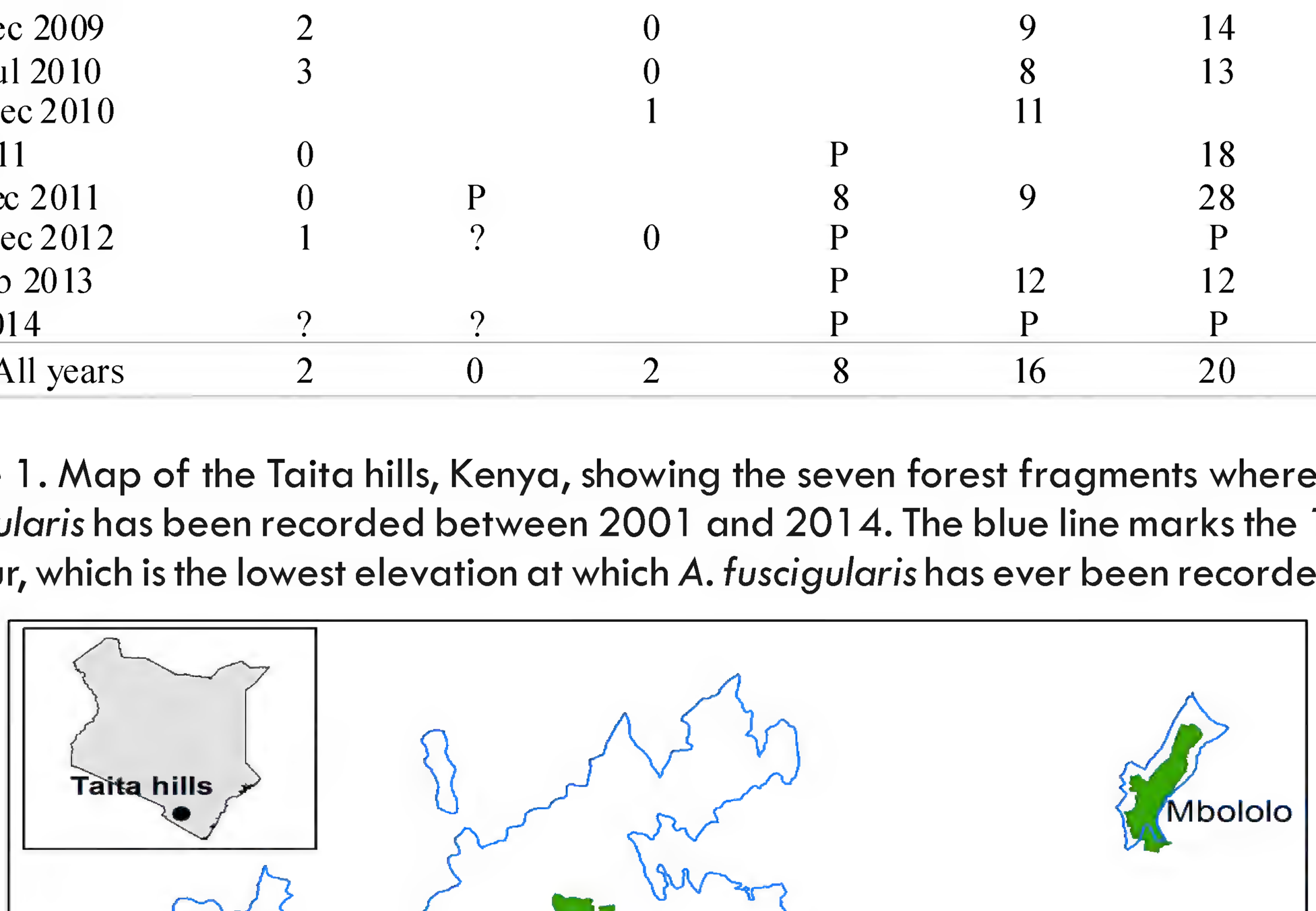
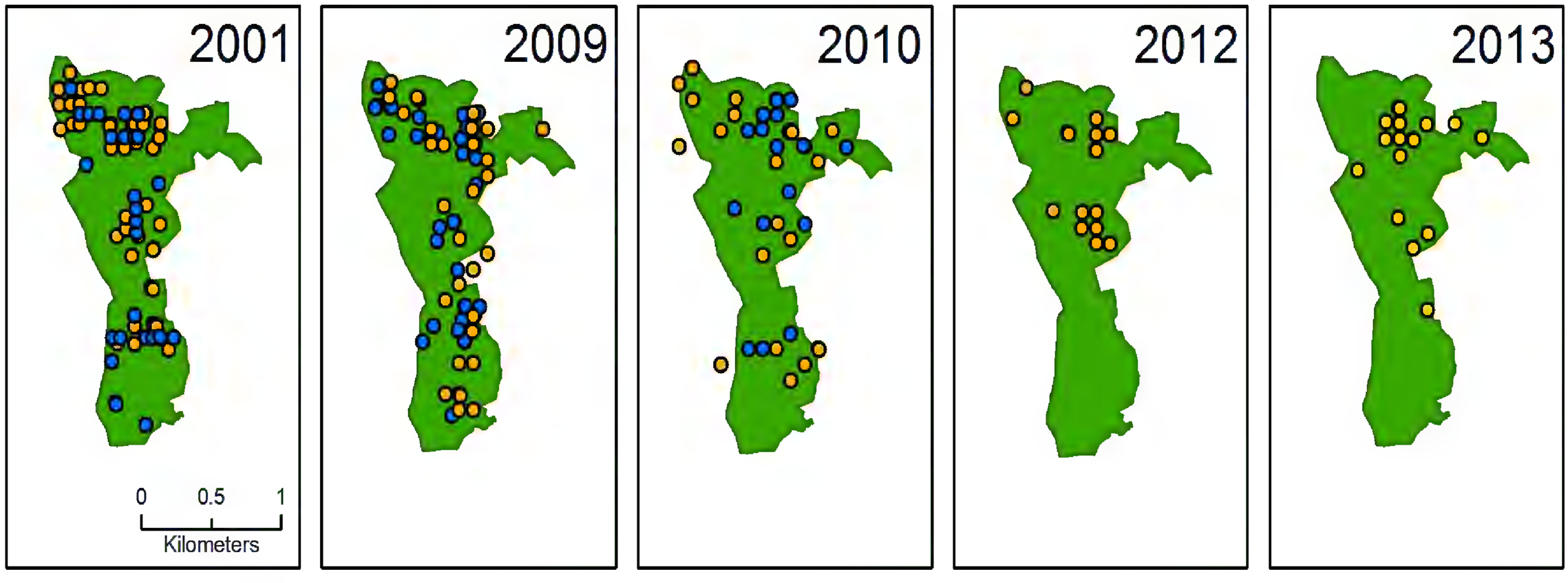


Figure 2. Observations of *Apalis fuscigularis* recorded during eight counting sessions performed in Ngangao forest fragment from 2001 to 2013. Yellow and blue symbols represent observations recorded in two separate count sessions performed in the same year. Sampling effort was approximately constant from 2009 to 2013 (182-199 points per session), but was lower in the two sessions performed in 2001 (108 points in May-June and 76 in August-September)



Appendix 4: Inventoried sites in EACF with IBA and KBA status and numbers of listed taxa in 2012 and 2013 (IBA and KBA status from www.birdlife.org/datazone/info/EAMSitListKen and www.birdlife.org/datazone/info/EAMSitListTan Boni and Dodori listed as IBA following www.conservationleadershipprogramme.org/ViewProject.asp?ProjectID=0132811)

Site name	Country	IBA	KBA	#taxa on database 2012	#threatened taxa 2013
Arabuko-Sokoke Forest	KE	Yes	Yes	20	36
Bagamoyo	TZ	No	Yes	2	3
Bagamoyo (Kikoka FR)	TZ	No	Yes	1	1
Bagamoyo District coastal forests	TZ	Yes	Yes	20	42
Boni and Dodori	KE	Yes	Yes	8	11
Buda FR	KE	No	Yes	12	21
Bungu	TZ	No	Yes	0	0
Cha Simba	KE	No	Yes	3	6
Chale Island	KE	No	Yes	3	3
Chuna Forest	KE	No	Yes	1	1
Dakatcha woodland	KE	Yes	Yes	8	7
Dar es Salaam coast	TZ	Yes	Yes	2	26
Diani Forest	KE	Yes	Yes	11	14
Dzitzoni	KE	No	Yes	1	1
Dzombo Hill Forest	KE	Yes	Yes	8	12
East Usambara Mountains	TZ	Yes	Yes	117	187
Gede Ruins National Monument	KE	Yes	Yes	2	1
Gongoni FR	KE	No	Yes	11	27
Handeni District coastal forests	TZ	Yes	Yes	9	28
Jozani FR, Zanzibar	TZ	Yes	Yes	10	9
Kambe Rocks	KE	No	Yes	1	4
Kaya Bombo	KE	No	Yes	1	1
Kaya Bura	KE	No	No	0	1
Kaya Chonyi	KE	No	Yes	2	3
Kaya Dzombo	KE	No	Yes	1	1
Kaya Fungo	KE	No	Yes	1	4
Kaya Gandini	KE	Yes	Yes	5	7
Kaya Gonja	KE	No	Yes	1	1
Kaya Jibana	KE	No	Yes	8	14
Kaya Kambe	KE	No	Yes	3	5

Site name	Country	IBA	KBA	#taxa on database 2012	#threatened taxa 2013
Kaya Kauma	KE	No	Yes	3	5
Kaya Kinondo	KE	No	Yes	3	6
Kaya Kivara	KE	No	Yes	4	5
Kaya Lunguma	KE	No	Yes	3	5
Kaya Miungoni	KE	No	Yes	2	3
Kaya Msambweni	KE	No	Yes	1	1
Kaya Mtswakara	KE	No	Yes	4	9
Kaya Muhaka	KE	No	Yes	7	13
Kaya Mwarakaya	KE	No	Yes	0	1
Kaya Puma	KE	No	Yes	1	1
Kaya Rabai	KE	No	Yes	8	16
Kaya Ribe	KE	No	Yes	10	12
Kaya Sega	KE	No	Yes	1	1
Kaya Teleza	KE	No	Yes	1	2
Kaya Timbwa	KE	No	No	0	2
Kaya Tiwi	KE	No	Yes	2	2
Kaya Ukunda	KE	No	Yes	5	4
Kaya Waa	KE	Yes	Yes	3	7
Kilifi District coastal forests	KE	No	No	0	26
Kilombero Valley	TZ	Yes	Yes	11	12
Kilwa District coastal forests	TZ	Yes	Yes	12	31
Kisarawe District coastal forests	TZ	Yes	Yes	35	62
Kisiju	TZ	No	Yes	3	3
Kisiju Island	TZ	No	No	0	1
Kisimani wa Ngoa	KE	No	Yes	2	2
Korogwe (Kwamshemshi Sisal Estate)	TZ	No	Yes	1	1
Kwale District coastal forests	KE	No	No	0	22
Kyngani River	TZ	No	No	0	1
Lamu District coastal forests	KE	No	No	0	28
Lango ya Simba	KE	No	Yes	0	0
Latham Island	TZ	Yes	Yes	0	0
Lindi (Kengedi)	TZ	No	Yes	1	1
Lindi (Mkindani)	TZ	No	Yes	2	2
Lindi (Ngongo)	TZ	No	Yes	1	1
Lindi (Nondora)	TZ	No	Yes	1	1
Lindi (Nyangao River)	TZ	No	Yes	2	1
Lindi (Ras Rungi)	TZ	No	Yes	1	1
Lindi (Tendaguru)	TZ	No	Yes	1	4
Lindi Creek	TZ	No	Yes	1	1
Lindi District coastal forests	TZ	Yes	Yes	46	82
Lower Tana River forests	KE	Yes	Yes	14	29
Lukoga FR	TZ	No	Yes	1	1
Lunghi Forest	KE	No	Yes	1	2

Site name	Country	IBA	KBA	#taxa on database 2012	#threatened taxa 2013
Mafia Island	TZ	Yes	Yes	12	15
Magombera FR	TZ	No	Yes	3	10
Mahenge	TZ	No	No	2	19
Mahenge (Kwiro Forest)	TZ	No	Yes	1	4
Mahenge (Liondo)	TZ	No	Yes	0	0
Mahenge (Lipindi)	TZ	No	Yes	1	1
Mahenge (Nambiga FR)	TZ	No	No	6	5
Mahenge (Sali)	TZ	No	Yes	6	18
Mahenge Scarp FR	TZ	No	Yes	2	2
Makongwe Island	TZ	No	Yes	1	1
Malundwe	TZ	No	No	0	2
Mangai	KE	No	No	0	1
Mangea Hill	KE	No	Yes	9	23
Marafa	KE	No	Yes	1	2
Marenji Forest	KE	Yes	Yes	7	7
Masasi	TZ	No	Yes	1	2
Masasi (Nyengedi)	TZ	No	Yes	1	1
Masasi District forests	TZ	No	No	0	8
Masasi East	TZ	No	Yes	1	1
Mikindani (Mnima)	TZ	No	Yes	0	0
Mikindani (Mtwara inland)	TZ	No	Yes	1	1
Mikindani District (Mtwara-Mikindani)	TZ	No	Yes	1	1
Mikumi NP	TZ	Yes	Yes	1	2
Mkomazi GR/NP	TZ	Yes	Yes	4	4
Mnazi Bay	TZ	Yes	Yes	0	1
Mombasa coast	KE	No	No	0	7
Mount Kasigau	KE	No	Yes	5	19
Mpanga Village FR	TZ	No	Yes	6	5
Mrima Hill Forest	KE	Yes	Yes	10	14
Mtanza FR	TZ	No	Yes	2	2
Mtwara	TZ	No	Yes	0	0
Mtwara District coastal forests	TZ	No	No	8	9
Muheza District coastal forests	TZ	Yes	Yes	13	24
Mwache FR	KE	No	Yes	5	9
Nachingwea District	TZ	No	No	0	2
Newala (Kitama)	TZ	No	Yes	1	1
Newala (Kitangari)	TZ	No	Yes	1	3
Newala (Mahuta)	TZ	No	Yes	1	1
Newala District coastal forests	TZ	Yes	Yes	10	9
Nguru Mountains	TZ	Yes	Yes	58	119

Site name	Country	IBA	KBA	#taxa on database 2012	#threatened taxa 2013
Nguu Mountains	TZ	Yes	Yes	14	19
North Pare Mountains	TZ	Yes	Yes	15	22
Nyumburuni FR	TZ	No	Yes	5	4
Nzovuni River	KE	No	Yes	1	1
Pande and Dodwe coastal forests	TZ	Yes	Yes	13	17
Pangani	KE	No	Yes	9	12
Pangani (Bushiri)	TZ	No	Yes	1	5
Pangani (Hale-Makinjumbe)	TZ	No	Yes	1	2
Pangani (Mauri)	TZ	No	Yes	1	1
Pangani (Mwera)	TZ	No	Yes	2	6
Pangani Dam	TZ	No	Yes	1	1
Pangani District coastal forests	TZ	Yes	Yes	10	15
Panza Island	TZ	No	Yes	1	1
Pemba Island	TZ	Yes	Yes	10	15
Ras Kituani	TZ	No	Yes	1	1
River Wami	TZ	No	Yes	2	4
Ruangwa District coastal forests	TZ	No	No	0	1
Rubeho Mountains	TZ	Yes	Yes	17	60
Rufiji Delta	TZ	Yes	Yes	1	1
Rufiji District coastal forests	TZ	Yes	Yes	29	48
Sabaki River Mouth	KE	Yes	Yes	1	1
Sangerawe	TZ	No	Yes	1	5
Selous GR	TZ	Yes	Yes	21	62
Semdoe	TZ	No	Yes	5	3
Shikurufumi FR	TZ	No	Yes	1	6
Shimba Hills	KE	Yes	Yes	53	83
Shimoni forests	KE	No	Yes	2	3
Sinza River - near UDSM	TZ	No	Yes	1	1
South Pare Mountains	TZ	Yes	Yes	34	64
Southeast coastal Kenya	KE	No	No	0	1
Taita District coastal forests	KE	No	No	0	5
Taita Hills forests	KE	Yes	Yes	31	57
Tana River Delta	KE	Yes	Yes	3	3
Tanga (Duga)	TZ	No	Yes	1	1
Tanga (Gombero FR)	TZ	No	Yes	1	1
Tanga (Morongo)	TZ	No	Yes	1	1
Tanga (Nyamaku)	TZ	No	Yes	1	1
Tanga (Pangani)	TZ	No	Yes	1	1
Tanga (Sigi River)	TZ	No	Yes	1	1

Site name	Country	IBA	KBA	#taxa on database 2012	#threatened taxa 2013
Tanga District coast	TZ	No	No	0	9
Tanga North-Kibo Salt Pans	TZ	Yes	Yes	0	0
Tanga South	TZ	Yes	Yes	0	0
Tumbatu Island	TZ	No	Yes	1	0
Udzungwa Mountains	TZ	Yes	Yes	79	161
Udzungwa Mountains National Park	TZ	Yes	Yes	80	136
Ukaguru Mountains	TZ	Yes	Yes	15	52
Ukwama FR	TZ	No	Yes	1	1
Uluguru Mountains	TZ	Yes	Yes	96	197
Utete (Kibiti)	TZ	No	Yes	2	3
Uvidunda Mountains	TZ	Yes	Yes	2	2
Uzaramo (Dar to Morogoro)	TZ	No	Yes	1	1
Uzaramo (Msua)	TZ	No	Yes	1	2
Verani South West	TZ	No	Yes	1	1
Vigola	TZ	No	Yes	1	1
West Usambara Mountains	TZ	Yes	Yes	72	165
Widespread in EACF		No	No	0	5
Witu FR	KE	No	Yes	12	21
Zanzibar (Kituani)	TZ	No	Yes	1	1
Zanzibar (Muyuni)	TZ	No	Yes	1	2

Appendix 5: Botanically uncollected protected areas of EACF in Tanzania by Region, District, and size

	Region	District	Protected Area	Size (km²)
1	Dodoma	Mpwapwa	Wota FR	11.60
2	Iringa	Iringa Rural	Kataplimwa FR	58.78
3	Iringa	Kilolo	Idewa FR	2.99
4	Iringa	Kilolo	Kisinga-Rugaro FR	178.60
5	Iringa	Mufindi	Irunda FR	3.93
6	Iringa	Mufindi	Kibao FR	1.17
7	Iringa	Mufindi	Mninga FR	1.94
8	Iringa	Mufindi	Ruande FR	6.30
9	Kilimanjaro	Mwanga	Kamwalla II FR	3.09
10	Kilimanjaro	Mwanga	Kileo East FR	1.75
11	Kilimanjaro	Same	Chongweni FR	1.02
12	Kilimanjaro	Same	Kankoma FR	0.72
13	Kilimanjaro	Same	Kisiwani FR	1.11
14	Lindi	Kilwa	Kianika Village FR	2.35
15	Lindi	Kilwa	Kibambo Village FR	0.34
16	Lindi	Kilwa	Kihundu Village FR	802.60
17	Lindi	Kilwa	Kikole 2 Village FR	19.80
18	Lindi	Kilwa	Kikole Village FR	4.57
19	Lindi	Kilwa	Kilungulungu Village FR	3.52
20	Lindi	Kilwa	Kisangi Village FR	40.70
21	Lindi	Kilwa	Kiwawa Village FR	43.06
22	Lindi	Kilwa	Malehi FR	397.03
23	Lindi	Kilwa	Mbinga FR	19.58
24	Lindi	Kilwa	Mchekela Village FR	0.24
25	Lindi	Kilwa	Mchonga Village FR	0.04
26	Lindi	Kilwa	Migeregere Village FR	11.10
27	Lindi	Kilwa	Ruhatwe Village FR	17.39
28	Lindi	Kilwa	Rungo FR	231.06
29	Lindi	Kilwa	Ulabo Village FR	0.05
30	Lindi	Lindi Rural	Ndimba FR	26.70
31	Lindi	Lindi Rural	Ntama FR	6.34
32	Lindi	Liwale	Angai FR	1425.38
33	Lindi	Nachingwea	Lionja FR	266.73
34	Lindi	Ruangwa	Nandimba FR	12.55
35	Morogoro	Kilombero	Masagati FR	16.91
36	Morogoro	Kilosa	Kihiliri FR	2.98

	Region	District	Protected Area	Size (km ^{2})
37	Morogoro	Kilosa	Mamboto FR	1.78
38	Morogoro	Kilosa	Uponera FR	3.45
39	Morogoro	Morogoro Rural	Chamanyani FR	8.12
40	Morogoro	Morogoro Rural	Kasanga FR	4.32
41	Morogoro	Morogoro Rural	Kilengwe FR	9.80
42	Morogoro	Morogoro Rural	Mangala FR	0.45
43	Morogoro	Morogoro Rural	Mvuha FR	7.64
44	Morogoro	Morogoro Rural	Pangawe West FR	1.98
45	Morogoro	Morogoro Rural	Vigoregoro FR	5.46
46	Morogoro	Morogoro Urban	Konga FR	0.19
47	Morogoro	Mvomero	Bunduki 3 FR	0.04
48	Morogoro	Mvomero	Disalasala FR	0.43
49	Morogoro	Mvomero	Kwangola FR	7.40
50	Morogoro	Mvomero	Mbogo FR	1.20
51	Morogoro	Mvomero	Mkangadala FR	0.15
52	Morogoro	Mvomero	Nyandiduna and Nyandira FR	1.01
53	Morogoro	Mvomero	Vigoza FR	0.48
54	Morogoro	Ulanga	Ligamba FR	0.33
55	Morogoro	Ulanga	Luhombero Luwegu FR	403.06
56	Morogoro	Ulanga	Myoe FR	1.21
57	Mtwara	Masasi	Chilangala FR	18.23
58	Mtwara	Masasi	Lukwika-Lumesuse GR	433.33
59	Mtwara	Masasi	Mbangala FR	367.90
60	Mtwara	Masasi	Msanjesi GR	223.07
61	Mtwara	Masasi	Nagaga FR	16.44
62	Mtwara	Masasi	Ngongwa-Busangi FR	9.55
63	Mtwara	Mtwara Rural	Maliendele FR	4.06
64	Mtwara	Mtwara Rural	Ziwani FR	6.46
65	Mtwara	Mtwara Urban	Maliendele FR	4.06
66	Mtwara	Newala	Chilangala FR	18.23
67	Mtwara	Tandahimba	Liteho FR	13.29
68	Mtwara	Tandahimba	Namikupa FR	30.33
69	Pwani	Bagamoyo	Simbo 2 FR	9.59
70	Pwani	Mkuranga	Marenda FR	2.13
71	Pwani	Mkuranga	Masanganya FR	23.59
72	Pwani	Rufiji	Kingoma FR	13.98
73	Pwani	Rufiji	Kipo FR	12.05

	Region	District	Protected Area	Size (km ^{2})
74	Pwani	Rufiji	Mohoro River FR	2.59
75	Pwani	Rufiji	Mtanza Msona FR	109.10
76	Pwani	Rufiji	Mtita FR	35.64
77	Pwani	Rufiji	Namakutwa Nyamulete FR	47.19
78	Pwani	Rufiji	Nambunju Village FR	20.86
79	Pwani	Rufiji	Ngulakula FR	22.85
80	Pwani	Rufiji	Nyamwage Village FR	1.29
81	Pwani	Rufiji	Ruhai River FR	799.44
82	Pwani	Rufiji	Rupiange FR	24.27
83	Pwani	Rufiji	Tawi Village FR	25.33
84	Tanga	Handeni	Bondo FR	28.73
85	Tanga	Handeni	Kwamarukanga FR	2.41
86	Tanga	Handeni	Kwasumba FR	30.54
87	Tanga	Handeni	Mtunguru FR	25.64
88	Tanga	Kilindi	Kiliguru FR	2.95
89	Tanga	Kilindi	Mamboto FR	3.15
90	Tanga	Kilindi	Mbegere FR	4.71
91	Tanga	Kilindi	Mkongo FR	5.58
92	Tanga	Kilindi	Mkoro FR	1.18
93	Tanga	Kilindi	Mkuli FR	31.64
94	Tanga	Kilindi	Msinko Hill FR	0.84
95	Tanga	Kilindi	Pumula FR	11.60
96	Tanga	Kilindi	Rudewa FR	5.81
97	Tanga	Kilindi	Talagwe FR	10.81
98	Tanga	Korogwe	Changandu FR	67.19
99	Tanga	Korogwe	Mfundia FR	8.04
100	Tanga	Korogwe	Mwenga FR	10.01
101	Tanga	Lushoto	Hebangwe FR	0.39
102	Tanga	Lushoto	Kikongoloi FR	2.70
103	Tanga	Lushoto	Kitara Ridge FR	7.86
104	Tanga	Lushoto	Kwedonda FR	1.24
105	Tanga	Lushoto	Manka FR	1.46
106	Tanga	Lushoto	Mazashai FR	0.52
107	Tanga	Lushoto	Mzogoti FR	1.48
108	Tanga	Lushoto	Ndasha FR	12.16
109	Tanga	Lushoto	Ndelemai FR	15.14
110	Tanga	Lushoto	Shambalai FR	0.22

Region		District	Protected Area	Size (km ^{2})
111	Tanga	Lushoto	Soni Public Land FR	0.37
112	Tanga	Lushoto	Zinge FR	0.10
113	Tanga	Muheza	Bosha East Village FR	0.01
114	Tanga	Muheza	Bosha North Village FR	0.03
115	Tanga	Muheza	Bosha South Village FR	0.04
116	Tanga	Muheza	Kihuhwi Teak FR	0.34
117	Tanga	Muheza	Kizee Village FR	0.40
118	Tanga	Muheza	Kizingata Village FR	0.07
119	Tanga	Muheza	Mfundia-bosha Village FR	0.13
120	Tanga	Muheza	Mpanga Village FR	0.25
121	Tanga	Pangani	Garafuno FR	2.89
122	Tanga	Pangani	Jasini FR	1.11
123	Tanga	Tanga	Bassi FR	0.25
124	Tanga	Tanga	Kolekole FR	2.86
	TOTAL			6680.22

BirdLife INTERNATIONAL

Partnership for nature and people

BirdLife International, Africa Partnership Secretariat, Volkers Garden on Terrace Close, Off Rhapta Road, Westlands.
P. O. Box 3502-00100 GPO Nairobi KENYA
T: +254 20 2473259 / 8068314
F: +254 020 8068315
M: +254 722 200538 / M: +254 734 600905

Cover Photo: Cosmas Mligo, Lawrence Wagura and Mercy Kariuki